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INBREEDING LEVELS IN DIFFERENT COUNTRIES*

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ONE OF THE PARAMETERS ENTERING INTO the general theory of the structure of populations is the inbreeding rate (Wright, 1922, 1951).

In man the value of this parameter is determined not only by physical but also by cultural and socio-economic factors. As a consequence, the estimation of rates of inbreeding is of interest to population geneticists, physical as well as cultural anthropologists, and sociologists; moreover, the ultimate elucidation of the factors controlling rates of inbreeding in man will require the talents of all of these disciplines.

It is doubtful whether inbreeding plays as important a role in modern human populations as it played in primitive societies or in the structuring of populations of most other animal species. This notion stems from two facts. First, human populations are, in the main, characterized by the avoidance of mating between the closest of relatives. Second, contemporary human populations have themselves been derived from more inbred populations of the past. The first of these tends to reduce enormously the inbreeding rates, and the second reduces the overall effect of inbreeding on the frequency of homozygosity for deleterious, recessive genes, genes which will have been heavily exposed to the action of natural selection in the past (for a discussion of this second problem, see Haldane, 1939). These facts notwithstanding, human populations are the only "natural" populations for which reasonably reliable estimates of inbreeding exist.

In spite of the fact that a considerable amount of energy has been expended in efforts to characterize the mating behavior of man, surprisingly little data of value to the population geneticist exists. This is primarily due to the failure to quantitate observations. Thus, information that a particular group is largely inbred, or practices preferentially cross-cousin marriage, or discourages unions between close relatives, etc., has little value in the evaluation of inbreeding coefficients though these statements may have meaning for the cultural anthropologist.

This paper will summarize the data thus far collected on several contemporary human populations, and will attempt to indicate the rather striking differences which exist. No attempt will be made, however, to delineate the factors responsible for this wide divergence of inbreeding rates.

European Countries

In Europe, data are available for a number of countries: for *France* (Boudin, 1862; Dally, 1864; Bertillon, 1872; Lacassagne, 1876; Stieda (1)*; Mulhal, 1892; Mayo-Smith, 1895; Wulz, 1925; Dahlberg, 1938;

* This paper has been prepared at the Department of Human Genetics of the University of Michigan, when the author was holding a fellowship from the Rockefeller Foundation.

* References followed by "1" to "4" were not seen in the original. The references are from: 1, Huth (1877), 2, Arner (1908), 3, v. Verschuer (1954) and 4, Kida *et al.* (1949).

Sutter and Tabah, 1948); *Scotland* (Mitchel, 1865); *England and Wales* (Down, 1866; G. H. Darwin, 1875a, b; Mulhal, 1892; Pearson, 1908a, b; Bell, 1940; Shields and Slater, 1956); *Germany* (Stieda, 1; Mulhal, 1892; Mayo-Smith, 1895; Feer, 1907 (2); Lenz, 1919; Spindler, 1922; Reutlinger, 1922; Wulz, 1925; auf der Nöllemburg, 1932; Dahlberg, 1938; Panse and Krings, 1949; Hoge, 1952 (3); Müller, 1953 (3); v. Verschuer, 1954); *Italy* (Stieda, 1; Mulhal, 1892; Mayo-Smith, 1895; Raseri, 1900; Wulz, 1925; Adamo, 1952; Cavalli-Sforza, 1956; Serra, 1956; Fraccaro, 1957; see also Table 1); *Ireland* (Cameron) 1883); *Norway* (Ucherman, 1901, 2); *Austria* (Orel, 1932); *Sweden* (Sjögren, 1948; Böök, 1948; Romanus, 1953; Larsson and Sjögren, 1954; Böök and Mawe, 1955; Böök, 1956; Larson, 1956; Fraccaro, 1956); *Switzerland* (Brenk, 1931; Grob, 1934; Egenter, 1934; Ruèpp, 1935); *Denmark* (Bartels, 1941; Kemp, 1950); *Holland* (Sutter and Tabah, 1948; see also Table 1); and *Northern Ireland* (Kilpatrick, Mathers, and Stevenson, 1955). Data for Portugal, based on official statistics, are presented in Table 1.

TABLE 1
FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN HOLLAND, ITALY AND PORTUGAL (Official statistics)[1]

Country	Period	N	UNi+ ANe	1C	T
Holland*	1936-'41	410,100	0.02	0.21	0.23
	1942-'47	409,345	0.02	0.14	0.16
	1948-'53	351,085	0.02	0.13	0.15
Italy**	1930	***	***	***	0.52
	1938	***	***	***	0.49
	1939	***	***	***	0.43
	1940	***	***	***	0.37
	1952	***	***	***	0.57
Port'g'l****	1940-'43	218,868	0.02	1.16	1.18
	1944-'47	251,045	0.05	0.90	0.95
	1948-'51	261,959	0.04	0.76	0.80
	1952-'55	276,800	0.05	1.40	1.45

* Data supplied by the Dutch Service of Information.

** Data supplied by the Central Institute of Statistics of Italy. These figures are underestimates of the real population parameters, according to a preliminary analysis of the problem in the Diocese of Milan (Serra, 1956). It is possible that the same criticism applies to data collected through the same method in other countries.

*** Data not available.

**** Data supplied by the National Institute of Statistics of Portugal.

With a few exceptions, the frequency of first cousin marriages found in these countries is in the neighborhood of one per cent. Some of the exceptions are to be found in Scotland, where villages with frequencies of 9 and 17 per cent are known; Norway, where it has been estimated that 7 per cent of marriages involve first cousins; a few communities in Germany and Switzerland where frequencies around 15 per cent have been encountered; and an isolated village in Sweden with a frequency of 7 per cent.

Asiatic Countries

Data are known for *Japan* (Kawakami, 1931 (4); Tsugawa, 1941 (4); Akimoto and Shiwazaki, 1941 (4); Neel, Kodani, Brewer and Anderson, 1949; Kida, Kanokogi, and Kojima, 1949; Schull, 1953); *India* (Sanghvi, 1954; Sanghvi, Varde and Master, 1956); and *Israel* (Goldschmidt and Ronen, 1956).

United States and Canada

Some information regarding the U. S. population in the 18th and 19th centuries has been given by Dean (1903, (2)), who assumed first cousin marriages were about 0.5 per cent of the total in Iowa, and Arner (1908), who, by using the method developed by G. H. Darwin (1875a), estimated the frequency of first cousin marriages in 18th century New York to have been 2.76 per cent, in a 19th century county in Ohio

[1] In this and in the following tables, N = total number of marriages contracted in the given period; $UNi+ANe$ = frequencies, in per cent, of marriages between uncles and nieces and between aunts and nephews; $1C$ = *idem* between first cousins; $1\frac{1}{2}C$ = *idem* between first cousins once removed; $2C$ = *idem* between second cousins; T = total frequency of consanguineous marriages up to and including second cousins; α = coefficient of inbreeding (identical to Wright's F) for autosomal genes; Sub-total = total not including the State capital indicated by #).

to have been 1.12 per cent, and in a large genealogy including about 7,500 marriages to be 1.07 per cent. Arner assumed a rate of 0.5 per cent for the total of the "more progressive American communities." Estabrook and McDougle (1926), in an analysis of a tri-racial isolate in Virginia, revealed that since the late 18th century, 7.23 per cent of the marriages were between first cousins, 4.82 per cent between first cousins once removed, and 7.83 per cent between second cousins. The incidence of consanguineous marriages up to and including fourth cousins was 49.40 per cent. No first cousin marriage has, however, been recorded among the 44 marriages contracted during the last two generations.

Information regarding contemporary American populations has been given by Glass (1950) and Steinberg (1950, 1956). A detailed analysis of the situation among the Mormons and their relatives, who show, as a whole, inbreeding rates at the same extremely low levels of the non-Mormon populations (about 0.05 per cent first cousin marriage) has been made by Woolf, Stephens, Mulaik, and Gilbert (1956). Brown (1951) analyzed 107 marriages in a rural population in Kentucky and found an inbreeding pocket with 6.5 per cent of first cousin, 0.9 per cent of first cousin once removed, and 11.2 per cent of second cousin marriages. The total frequency up to and including fourth cousins was as high as 38 per cent. Herndon and Kerley (1952) studied another predominantly rural population in the mountains of North Carolina and found that from 1830 to 1950 1.57 per cent of marriages involved first cousins, and a total frequency through second cousins of 6.72 per cent. During the period 1910-1950, these frequencies were, respectively, about 0.6 and 4 per cent. Compared to the situation in the general population of the United States, even these rates can be considered as very high. This "high" frequency of first cousin marriages (0.06 per cent), characteristic of a rural and somewhat isolated American population *in the period 1910-1950*, is similar to those found in Rio de Janeiro and São Paulo, Brazil's largest urban centers, and in Buenos Aires and Montevideo, *in recent times*.

For Canada, the only data available refer to a small parish, St. Denis, where 4.5 per cent of the marriages involve relatives up to and including third cousins (Miner, 1939).

Argentina and Uruguay

Data from the Archdiocese of Buenos Aires, which includes only the city of Buenos Aires and the Martin Garcia Island, and from the Archdiocese of Montevideo, which encompasses six of the 19 Uruguayan departments, are presented in Table 2. The data are inadequate for an estimate of the total inbreeding level in Argentina as a whole. For Uruguay, however, as our data refer to about 50 per cent

TABLE 2.
FREQUENCY OF CONSANGUINEOUS MARRIAGES IN ARGENTINA AND URUGUAY

Populations	*Period*	*N*	$UNI + ANe$	1C	1½C	2C	*T*	α
ARGENTINA								
Buenos Aires and Martin Garcia Island	1954	23,000*	0.03	0.72	0.05	0.14	0.94	0.00053
URUGUAY								
Dept. of Montevideo	1952	3,955	0	0.81	0.13	0.17	1.11	0.00057
Other departments**	1952	1,415	0	0.85	0.28	1.06	2.19	0.00078
Total		5,370	0	0.82	0.17	0.41	1.40	0.00063

* Approximate number.
** Canelones, San José, Lavalleja, Maldonado, and Rocha. They form, together with the Department of Montevideo, the Archdiocese of Montevideo.

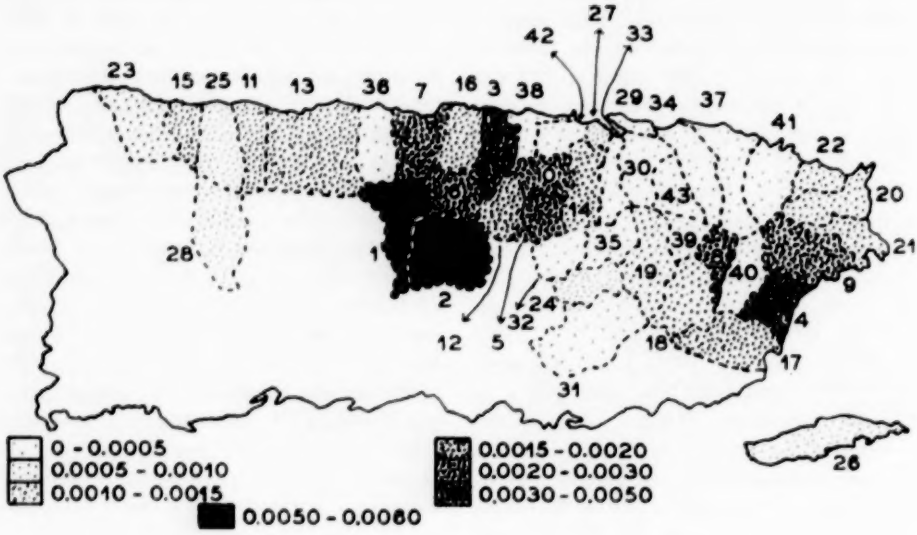

FIGURE 1—Distribution of inbreeding levels in the different municipalities belonging to the Diocese of San Juan, Puerto Rico. The numbers correspond to those of Table 3. Different shades correspond to different coefficients of inbreeding. The Viques Island (26) is not presented at its real position.

of the whole population, it would appear that the frequency of first cousin marriages is in the neighborhood of 1 per cent.

Puerto Rico

Puerto Rico is divided into two dioceses of about equal size, San Juan and Ponce (*cf.* Figure 1). The incidence of consanguineous marriages in each of the parishes of the Diocese of San Juan is given in Table 3; similar observations are not available for the Diocese of Ponce. Figure 1 shows the distribution of the different inbreeding levels in the Diocese of San Juan.

Brazil

Tables 4-7 present data which, supplemented by data previously published (Freire-Maia, 1952, 1954, 1957a), afford a rather complete picture of the inbreeding levels obtaining throughout Brazil (Figure 2). The method of data collection and implications of these data have been presented *inextenso* elsewhere (Freire-Maia, 1952, 1957a,b).

TABLE 3.

FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN PUERTO RICO

Diocese of San Juan, 1954

Localities	*N*	*UNi + ANe*	1C	1½C	2C	*T*	*a*
1. Ciales	88	0	6.82	3.41	4.54	14.77	0.00604
2. Orocovis	131	0	6.11	2.29	6.87	15.27	0.00561
3. Vega Alta	54	0	7.41	0	0	7.41	0.00463
4. Humacao	204	0	2.45	2.45	4.41	9.31	0.00329
5. Naranjito	69	0	4.35	0	1.45	5.80	0.00294
6. Morovis	191	0	2.62	1.04	4.19	7.85	0.00262
7. Manati	73	0	4.11	0	0	4.11	0.00257
8. Juncos	68	0	1.47	2.94	4.41	8.82	0.00253
9. Naguabo	83	0	2.41	1.20	3.62	7.23	0.00245
10. Toa Alta	92	0	2.17	3.26	0	55.43	0.00238
11. Hatillo	56	0	1.79	0	5.36	7.14	0.00195
12. Corozal	105	0	2.86	0	0	2.86	0.00179
13. Arecibo	327	0	2.14	0.61	0.92	3.67	0.00167
14. Bayamón + V. Caparra	252	0	1.99	0.79	1.19	3.97	0.00167
15. Quebradillas	123	0	2.44	0	0.81	3.25	0.00165
16. Vega Baja	134	0	1.49	1.50	1.49	4.48	0.00163
17. Yabucoa	144	0	1.39	2.08	0.69	4.16	0.00163
18. San Lorenzo	197	0	1.52	0.51	1.02	3.05	0.00135
19. Caguas	370	0.27	1.08	0.27	1.08	2.70	0.00135
20. Fajardo + Ceiba (21) + Luquillo (22)	96	0	1.04	2.08	0	3.12	0.00130
23. Isabela	147	0	1.36	0.68	0	2.04	0.00128
24. Cidra	235	0	0.85	0.42	1.28	2.55	0.00086
25. Camuí	75	0	1.33	0	0	1.33	0.00083
26. Vieques	38	0	0	2.63	0	2.63	0.00082
27. Cataño	97	0	0	1.03	3.09	4.12	0.00081
28. Lares	173	0	0.58	1.15	0.58	2.31	0.00081
29. San Juan + Rio Piedras (30)	1495	0	0.67	0.06	0.07	0.80	0.00045
31. Cayey	192	0	0.52	0	0.52	1.04	0.00041
32. Comerio	118	0	0	0.85	0.85	1.70	0.00040
33. Guaynabo	100	0	0	1.00	0	1.00	0.00031
34. Carolina	67	0	0	0	1.49	1.49	0.00023
Others*	419	0	0	0	0	0	—
TOTAL	6013	0.02	1.46	0.68	1.12	3.28	0.00132

* Aguas Buenas (N-97, Virgin Islands (St. Thomas, 16; Fredericksted, 17; Holy Cross, 20), 36 Barceloneta (52), Canovanas (25), 38. Dorado (12), 39. Gurabo (34), 40. Las Piedras (29), 41. Rio Grande (29), 42. Toa Baja (31), and 43. Trujillo Alto (58).

TABLE 4.

FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN THE SOUTHERN BRAZILIAN STATE OF SANTA CATARINA

Archdiocese of Florianópolis,* 1950-1951.**

Localities	*N*	*UNi + ANe*	1C	1½C	2C	*T*	*a*
Ilhota	10	0	10.00	0	20.00	30.00	0.00938
Armazem	180	0	3.89	2.78	5.56	12.22	0.00417
Nova Trento	124	0	3.23	1.61	3.23	8.07	0.00302
Angelina	97	0	1.03	1.03	11.34	13.40	0.00274
Botuverá	103	0	1.94	2.91	3.89	8.74	0.00273
Tubarão	492	0	1.02	0.20	2.64	3.80	0.00111
Nova Veneza	122	0	3.28	0.82	1.64	5.74	0.00256
Araranguá	290	0	2.41	0.35	2.76	5.52	0.00205
Brusque	510	0	1.18	0.39	2.75	4.31	0.00129
Palhoça	103	0	1.94	0	0	1.94	0.00121
Criciuma	539	0	1.48	0.19	0.37	2.04	0.00104
Itajaí	589	0.17	0.68	0.51	1.36	2.72	0.00101
Airuê	67	0	1.49	0	0	1.49	0.00093
Florianópolis	1,135	0	0.09	0.09	0.17	0.35	0.00011
Sub-Total	3,226	0.03	1.55	0.68	2.42	4.68	0.00156
TOTAL	4,361	0.02	1.17	0.53	1.83	3.55	0.00121

* Incomplete data.

** With exception of Florianópolis (1948-1951).

TABLE 5.

FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN THE EASTERN BRAZILIAN STATE OF RIO DE JANEIRO

Diocese of Valença, 1954

Localities	*N*	*UNi + ANe*	1C	1½C	2C	*T*	*a*
S. Isabel do Rio Preto	18	0	5.56	0	0	5.56	0.00347
Japuranã	60	0	5.00	0	0	5.00	0.00339
Miguel Pereira	29	0	3.45	0	3.45	6.90	0.00269
Parapeúna	43	0	2.32	0	2.33	4.65	0.00182
Paraiba and Encruzilhada	144	0	2.08	1.39	0	3.47	0.00174
Valença	149	0	2.01	0	0	2.01	0.00126
Sapucáia	70	0	1.43	0	0	1.43	0.00089
Pati	91	0	1.10	0	0	1.10	0.00069
Tres Rios	171	0	0.58	0.59	0	1.17	0.00055
Others	497	0	0	0	0	0	—
TOTAL	1272	0	1.18	0.23	0.16	1.57	0.00085

TABLE 6.

FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN THE EASTERN BRAZILIAN STATE OF SERGIPE.

Diocese of Aracajú, 1954

Localities	*N*	*UNi + ANe*	1C	1½C	2C	*T*	*a*
Riachão	18	0	22.22	16.67	5.55	44.44	0.01997
Ribeirópolis	117	0	11.11	3.42	4.27	18.80	0.00868
Frei Paulo	178	1.12	7.87	0.56	2.81	12.36	0.00729
Porto da Folha	67	0	8.96	0	5.97	14.93	0.00653
Simão Dias	200	0.50	7.50	1.50	4.00	13.50	0.00641
Itabaianinha	204	0	8.82	0.98	0.98	10.78	0.00628
Itabaiana	197	0	8.12	1.02	2.03	11.17	0.00571
Gararu	54	0	7.41	0	5.55	12.96	0.00550
Divina Pastora	12	0	8.33	0	0	8.33	0.00521
Siriri	19	0	5.26	0	5.26	10.52	0.00411
Tobias Barreto	277	0	5.06	0.72	3.97	9.75	0.00401
Japoatã	142	0	5.63	0	1.41	7.04	0.44374
Aquidabã	174	0	4.02	2.30	1.15	7.47	0.00341
N. S. das Dores	181	0.55	3.32	0	2.21	6.08	0.00311
Boquim	67	0	4.48	0	0	4.48	0.00280
Cristianápolis	24	0	4.17	0	0	4.17	0.00260
Cedro	78	0	3.85	0	0	3.85	0.00240
Canhoba	63	0	1.59	0	4.76	6.35	0.00223
Campo do Brito	118	0	3.39	0	0	3.39	0.00212
Arauã	34	0	2.94	0	0	2.94	0.00184
Japaratuba	51	0	1.96	0	0	1.96	0.00123
Capela	85	0	1.18	1.17	0	1.35	0.00110
Aracajú #	487	0	1.64	0	0.21	1.85	0.00106
Propriá	78	0	1.28	0	2.57	3.85	0.00094
Neópolis	76	0	1.32	0	0	1.32	0.00082
Estância	91	0	1.10	0	0	1.10	0.00069
Laranjeiras	66	0	0	1.52	0	1.52	0.00047
Lagarto	256	0	0.39	0	0.39	0.78	0.00031
São Cristóvão	64	0	0	1.56	6.25	7.81	0.00015
Others	337	0	0	0	0	0	—
TOTAL	3,815	0.10	4.04	0.63	1.65	6.42	0.00315

TABLE 7.
FREQUENCIES OF CONSANGUINEOUS MARRIAGES IN THE NORTHEASTERN BRAZILIAN STATE OF ALAGOAS.
Diocese of Penedo, 1954

Localities	*N*	*UNi + ANe*	1C	1½C	2C	*T*	*a*
Traipú	157	0.64	12.74	1.91	7.64	22.93	0.01055
Delmiro Gouveia	154	0.65	9.09	3.90	6.49	20.13	0.00944
Pão de Açúcar	228	0.44	7.46	4.38	4.39	16.67	0.00761
Agua Branca	156	0.64	7.69	2.57	6.41	17.31	0.00731
Colégio (Porto Realdo)	92	0	8.70	2.17	5.43	16.30	0.00696
São Brás	143	0	9.09	1.40	2.80	13.29	0.00677
Mata Grande	288	0.35	6.95	2.08	4.86	14.24	0.00646
Palmeira dos Indios	350	0.29	6.86	1.71	3.71	12.57	0.00629
Limoeiro de Anadia	187	0	6.95	1.07	3.74	11.76	0.00526
Junqueiro	148	0	7.43	0	2.03	9.46	0.00496
Arapicaca	383	0	5.22	1.31	3.13	9.66	0.00441
Major Isidoro	185	0	5.41	0.54	1.62	7.57	0.00414
Belo Monte	128	0	6.25	0	0.78	7.03	0.00403
Igreja Nova	144	0	3.47	3.48	3.47	10.42	0.00401
Santana do Ipanema	504	0	3.97	2.18	2.38	8.53	0.00384
Coruripe	102	0	4.90	0	0.98	5.88	0.00322
Piaçabuçú	70	0	0	4.28	1.43	5.71	0.00156
Penedo	147	0	1.36	0	0.68	2.04	0.00096
TOTAL	3,566	0.17	6.22	1.85	3.48	11.72	0.00547

Jamaica

No actual data are available on the inbreeding levels in this British Colony. Davenport and Steggerda (1929; pp. 14, 17, and 442) and Doran (1942) have asserted, however, that the frequency of consanguineous marriages is high. In Seaford Town, a high level of inbreeding is said to prevail. In this community there exists a white isolate of German origin. The genealogy of one of the families of this group, Kameka, has been given by Davenport and Steggerda (1929; plate 29, *cf.* their Table 332). Analysis of this genealogy affords some notion of the frequency of consanguineous marriages in this white isolate (Table 8). The original description of the pedigree is not particularly clear, and our estimates must be viewed as rough approximations of the actual inbreeding rate existent in the family.

TABLE 8.
ROUGH ESTIMATE OF THE INBREEDING RATE IN THE PEDIGREE OF THE "KAMEKA" FAMILY (*Apud* DAVENPORT AND STEGGERDA, 1929).

Generation	*N*	1C	1½C	2C	*T*
1	1	—	—	—	—
2	9	—	—	—	—
3•	33	15.15	12.12	3.03	30.30
4•	48	4.17	4.17	8.33	16.67
TOTAL	91	7.69	6.59	5.50	19.78
3 + 4	81	8.64	7.41	6.17	22.22

• Since assignment of 1½*C* to one or the other generation is purely arbitrary, we have maintained in this table the positions found in the original genealogical chart.

Discussion: The Comparability of the Data

The methods which have been used to obtain data on inbreeding in different populations are sufficiently dissimilar that it is unlikely that the data are strictly comparable. In some instances, the entire populations of small communities have been studied, and, presumably, the data so obtained will yield a clear and trustworthy picture of the situation at that particular time in the history of the community. More frequently, it has been necessary to sample marriages, and consequently the data may or may not be representative of the true situation. Among the sampling procedures which have been employed are survey of physicians' families through a questionnaire published in a medical journal (Pearson, 1908a,b), hospital file analysis (Bell, 1940), students' families surveys (Kawa-

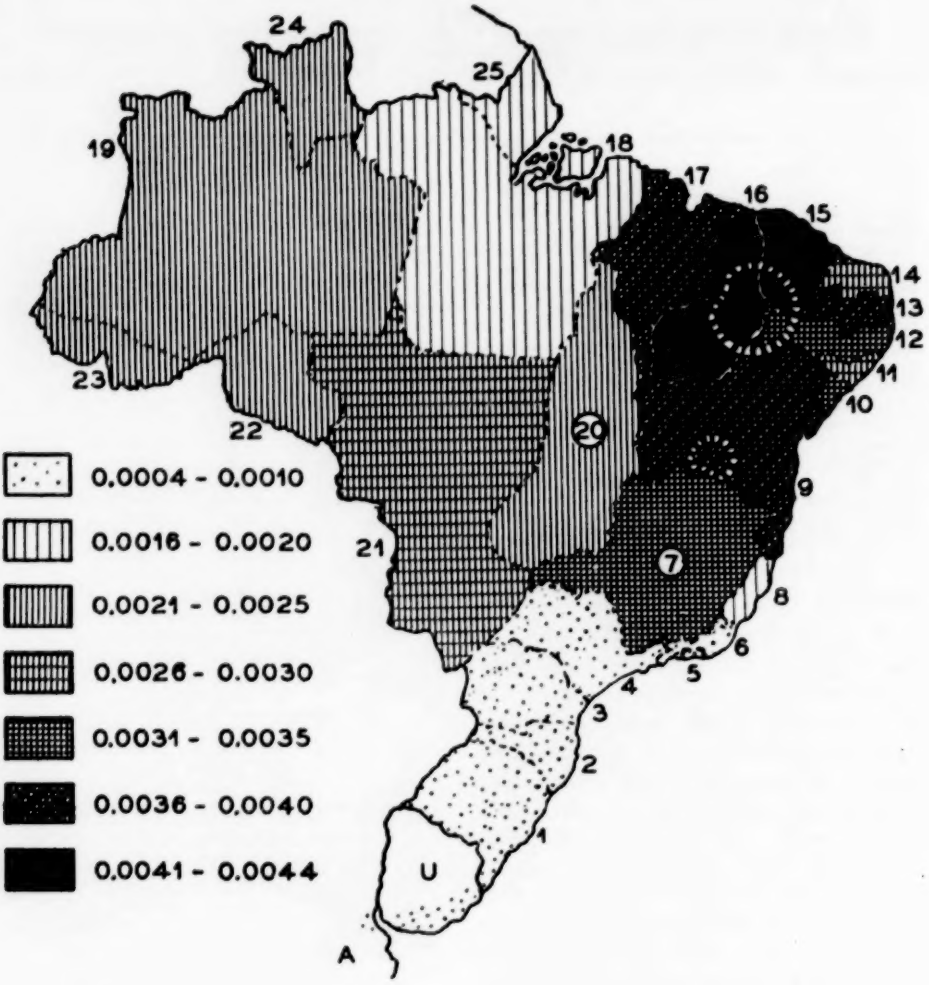

FIGURE 2—Distribution of the inbreeding levels in the Brazilian territory, according to the estimates for the States and Federal District (Freire-Maia, 1957), assuming that the four territories have the same level as the contiguous States.

SOUTHERN STATES—1. Rio Grande do Sul; 2. Santa Catarina; 3. Paraná; 4. São Paulo;

THE FEDERAL DISTRICT—5. (where the city of Rio de Janeiro is located);

EASTERN STATES—6. Rio de Janeiro; 7. Minas Gerais; 8. Espirito Santo; 9. Bahia; 10. Sergipe;

NORTHEASTERN STATES—11. Alagoas; 12. Pernambuco; 13. Paraíba; 14. Rio Grande do Norte; 15. Ceará; 16. Piauí; 17. Maranhão;

NORTHERN STATES—18. Pará; 19. Amazonas;

WEST-CENTRAL STATES—20. Goiás; 21. Mato Grosso;

TERRETORIES—22. Guaporé; 23. Acre; 24. Rio Branco; 25. Amapá.

Zones with the highest inbreeding levels in Brazil (α from 0.007 to 0.010) are indicated by two circular outlines. The figure also presents the approximate regions in Argentina (A) and Uruguay (U) for which information is available (*cf.* Table 2).

kami, 1931), home visits (Frota-Pessoa and Filkueiras, 1957), visit to homes with newly born children (Kilpatrick *et al.*, 1955), pregnant women registration (Neel *et al.*, 1949), analysis of genealogical charts (Ellis, 1936), survey of applicants for legal abortion (Romanus, 1953), official marriage records (Larsson and Sjögren, 1954), etc. A simple enumeration of these techniques is, in itself, sufficient to suggest that it is unlikely that the results of such surveys would be strictly comparable.

Another factor affecting the comparability of the information from different countries is the disparity in the number of regions or localities which have been sampled. Nations widely surveyed have a greater probability of presenting widespread variation in the local or regional inbreeding rates than those countries which have been studied only superficially. In addition, some data referring to "localities" include the surrounding rural areas and are not, therefore, comparable to information taken from strictly urban populations.

In some countries, official statistics provide information on the number of consanguineous marriages contracted each year, but the data so obtained underestimate the true population parameters (Serra, 1956). In Catholic countries, the data obtained through dispensations granted by ecclesiastical authorities to the canon impediments of consanguinity seem to be quite reliable, but they do not describe the inbreeding level of populations in a given time, but only the inbreeding level of a segment of these populations, namely, the fraction of the population which marries in a specific period. Thus, for example, Brazilian contemporary populations may show inbreeding levels as much as 20 per cent higher than those detected among recently contracted Catholic marriages. With official as well as Catholic data, an estimate of the inbreeding level of a population can be

TABLE 9.

INBREEDING LEVELS IN DIFFERENT COUNTRIES

Freq. of 1C%	*The Whole Nation*	*Regions*	*"Localities"*
20–23			B
15–20			B In" Is=
11–15			B In" J
10–11		B	B Is=
9–10		B	B In" Is= J
8–9		B	B In" Is= J
7–8		J	B In" Is= J P
6–7		B US+r	B J P Sw
5–6	J?	B	B Is= J
4–5		B J	B In" J P
3–4		B	B In" J Sw
2–3	B	B P: Sw	B Is= P Sw U US•
1–2	P? Po?	B D F G I N P: Sw	B D In" Is= P Sw S U US•
0.5–1	D F I? N? U?	A B F G I N P: U US•+r	Ar B D F In" P Sw U US•
0.1–0.5	E? G? H?	B E' F G I N US•	B F P Sw U US•
0–0.1	US+?	I P: Sw US•+	B US•+

A—Austria; Ar—Argentina; B—Brazil; D—Denmark; E—England and Wales; F—France; G—Germany; H—Holland; I—Italy; In—India; Is—Israel; J—Japan; N—Northern Ireland; P—Puerto Rico; Po—Portugal; S—Switzerland; Sw—Sweden; U—Uruguay; US—United States.

+—General population (US).
' —Parents of hospitalized children (England and Wales).
:—"Regional groups" as defined by Thieme (1952).
•—Mormons and their relatives (US).
r—Rural populations (US).
"—Non-Christian endogamous groups in Bombay.
.—Christians in Bombay.
=—"Communities" (Israel).

obtained by indirect methods; these estimates are, of course, subject to a number of biases.

Conclusions

Table 9 summarizes the mean incidences of first cousin marriages detected in recent years in a number of countries. As has been pointed out, these data are not strictly comparable, and inferences from these data must be cautiously drawn. The following general conclusions can be drawn, however, from a consideration of Table 9:

1. The highest local rates of inbreeding are to be found in Brazil, Japan, India, and Israel. The Japanese mean frequency is, however, higher than the corresponding figure for Brazil. It is not clear how Japan would compare with Israel or India.

2. American populations are noteworthy in their extremely low inbreeding rates. The mean frequency of first cousin marriages in the United States is probably lower than 0.1 per cent.

3. Some localities in Puerto Rico and Sweden show "intermediate" inbreeding levels, being half-way between the extremes found in the U. S. and Brazil and Japan.

4. In several European countries, notably, Denmark, France, Italy, and North Ireland, the mean frequency of first cousin marriages is certainly less than 1 per cent. In England, Wales, Germany, and Holland, this frequency is probably lower than 0.5 per cent; whereas in Portugal, it may lie between 1 and 2 per cent.

5. Two Latin American countries, Uruguay and Puerto Rico, exhibit inbreeding rates lower than Brazil's. The frequency of first cousin marriages in Uruguay is probably in the neighborhood of 1 per cent.

Summary

A review is made of the general levels of inbreeding in contemporary populations of several countries. Data on Catholic marriages are presented for Brazil, Puerto Rico, Uruguay and Argentina. In addition, information based on official statistics is given for Portugal, Holland, and Italy.

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HEREDITY COUNSELING IN EYE DISEASES*

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I

INTRODUCTION

AMONG THE DIFFERENT BRANCHES OF MEDICINE, ophthalmology is particularly well placed for the study of human genetic changes. First, hereditary ocular characteristics and lesions are numerous. Secondly, the transparent media of the eye permit examination of the lesions with a precision unknown in the other domains of medicine. This is why ophthalmologists have also become geneticists.

For a physician genetics must not only be a pure science but a useful science to his patients. Medical art naturally consists in healing, but it also consists more and more in prevention. It is essentially in preventing the dissemination of hereditary diseases that genetics finds its usefulness. In the present state of our society prevention cannot be practiced in the whole population. Obligatory social eugenics, which gravely restricts the individual liberty of the parents, is not applicable today nor to be hoped for in the future, to our way of thinking at least. On an individual basis, however, the physician may be called on to counsel parents on the risk of having a child with a particular disease. He establishes a genetic prognosis founded on the study of the family in question (number of cases, consanguinity, etc.) and on the laws of genetics which apply to this disease. This genetic prognosis permits the physician to express in percentages the risk for the parents of having children with this disease. If the risk is high, it may be best to advise against procreation, and possibly even against marriage, but of course this is only a suggestion. The final decision rests with the husband and wife, who are free to act as they please.

The establishment of a genetic prognosis always requires study of the individual family, calculation, and often meticulous research. That is why we thought it would be useful to draw up tables which recapitulate the large majority of the situations in which consultation is sought. On the left of the tables are listed those diseases which are sufficiently grave to justify a genetic consultation. In the remaining columns are the appropriate prognoses according to the family history, for example, father affected, no other cases in the family, parents first cousins. The designation of relationships is always given in relation to the child to be born.

Families may also be classified according to the mode of transmission of the disease. For example, in the case of retinitis pigmentosa (a degenerative disease of the eye that eventually leads to blindness) the risk is the same when any grandparent is affected, but in sex-linked diseases, such as color-blindness, the risk depends on which of the four grandparents is affected.

In order to avoid one excessively large and inconvenient table, we have made three

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tables: one for the autosomal (not sex-linked) recessive diseases, one for the autosomal dominant diseases, and one for the sex-linked diseases. The following symbols are used in the tables:

R = Risk of the child being born with a certain disease

P = Penetrance of the gene

II

RECESSIVE AUTOSOMAL EYE DISEASES

(See Table 1)

We have considered only those eye diseases sufficiently important to require consultation: albinism, retinitis pigmentosa, infantile amaurotic idiocy (Tay-Sachs), juvenile amaurotic idiocy, congenital glaucoma, pseudoxanthoma elasticum (angioid streaks of the retina), and high myopia.

By definition, a recessive gene in the heterozygous state, *aá*, is concealed by the normal allele and is detected only in the homozygous state, *áá*. Consequently, in order for the children to be stricken, both parents must be carriers of the pathological gene, though they are rarely afflicted themselves. Related parents are especially likely to have the same genes. Therefore, the risk of recessive disease is particularly great in consanguineous unions.

The genetic prognosis of a recessive disease depends largely upon the frequency of the disease in the population. This frequency (q^2) has been established empirically by different authors, in particular by Kemp for Denmark. From this frequency it is easy to estimate the number of heterozygotes, *i.e.*, latent carriers of the specific disease ($2\sqrt{q^2}$). For example, the frequency of retinitis pigmentosa is $q^2 = 1:20{,}000$. This disease is happily very rare, but there are a large number of latent carriers: $2\sqrt{q^2} = 1:71$. The heterozygotes are thus 280 times as numerous as the people who are affected.

1. If a family has no members affected by a specific disease and if the parents are not related, the risk of a child's being stricken is almost nil. It is equal to the frequency of the disease in the population.

$R = 2q \cdot 2q \cdot \frac{1}{4} = q^2$

2. If the family history is negative but the parents are related, the risk is considerably augmented. This supplementary risk can be calculated from special formulae which are not presented here for lack of space.

Let us take again the example of retinitis pigmentosa. While non-consanguineous parents have one chance in 20,000 of having a child stricken, parents who are first cousins have about one chance in 2,000. Their descendants thus carry a tenfold genetic risk.

3. If one of the parents is affected but the parents are unrelated, the risk is small for his offspring. His children will all be carriers but healthy, unless his wife is also a carrier in which case one-half the children would be affected.

$R = 2q \cdot \frac{1}{2} = q.$

4. Consanguinity will naturally augment the above risks (see Table 1). The formulae are also not presented here for lack of space.

5. If both parents are affected, all the children must also be: $R = 100$ per cent. Only in congenital glaucoma do we see an exception. We believe today that this gene is not always expressed, even in its homozygous state (Westerlund).

6. If healthy parents have already had an affected child, the risk for those to follow is 1:4.

7. If an affected parent has a child already stricken like himself, the risk for those who follow is 1:2, since disease in one child proves that the other parent is heterozygous.

8 & 9. Finally the tables show the relative risks of disease when a grandparent or an uncle or aunt are affected. These risks are, respectively,

$R = \frac{q}{2}$ and $R = \frac{q}{3}$

TABLE 1

RECESSIVE AUTOSOMAL EYE DISEASES

EYE DISEASE	Degree of Accuracy of Genetic Prognosis ••• accurate •• approximate • very approximate	R = Risk in % of the next child being affected when–								
		No Case in Family		Father or Mother Affected						
		No consanguinity $R = q^2$	Father and mother first cousins	No consanguinity $R = q$	Father and mother first cousins	Father and Mother Affected	One Child Affected, Parents Not Affected	Father or Mother Affected, One Child Affected	One Grandparent Affected	One Uncle or Aunt Affected
ALBINISM	•••	0.0067	0.058	0.82	13.3	100	25	50	0.41	0.27
RETINITIS PIGMENTOSA	•••	0.005	0.049	0.71	13.2	100	25	50	0.36	0.24
INFANTILE AMAUROTIC IDIOCY (Tay-Sachs)	••	0.0004	0.012	0.2	12.7	100	25	50	0.1	0.07
JUVENILE AMAUROTIC IDIOCY	••	0.0025	0.031	0.5	13.0	100	25	50	0.25	0.17
CONGENITAL GLAUCOMA	•	0.008	0.063	0.9	8.4	60	15	30	0.45	0.3
PSEUDOXANTHOMA ELASTICUM (Angioid streaks of the retina)	••	0.0067	0.058	0.82	13.3	100	25	50	0.41	0.27
HIGH MYOPIA	•	4	5	20	32.5	100	25	50	10	6.6

III

DOMINANT AUTOSOMAL EYE DISEASES

(See Table 2)

We have indicated twenty dominant eye diseases sufficiently grave to have need of a genetic consultation. These are:

Congenital cataracts, dystrophia myotonica, hemeralopia (Nougaret's type), granular corneal dystrophy, lattice-like corneal dystrophy, familial atrophy of the optic nerve (different from Leber's disease) aniridia, glaucoma, neurofibromatosis (von Recklinghausen), osteopsathyrosis (Lobstein), retinoblastoma, ptosis congenita, epiloia (tuberous sclerosis) (von Hippel-Lindau's disease), craniofacial dysostosis (Crouzon), colobomatous conditions, oxycephaly, Marfan's syndrome, acrocephalosyndactily (Apert), Struge-Weber's disease.

We know today that diseases called dominant are rarely completely dominant. There are practically always a certain number of heterozygotes who apparently are not affected. What we call the penetrance of the gene is the percentage of heterozygotes obviously stricken. The calculation of penetrance is most important for the genetic prognosis of dominant conditions. In effect the risk is always less than that predicted by the Mendelian ratio for absolute dominance. We cannot discuss here the different ways of calculating this penetrance. Our estimates are based on the published literature and on our personal calculations and evaluations.

1. In order to shorten the table, we have omitted mention of the risk of a stricken child in a family in which there has never been a manifestation. With or without consanguinity this risk is practically nothing. It is equal to the rate of mutation.

2. If one parent is affected, the risk of the next child being affected is 1:2, a risk which is proportionately diminished according to the lack of penetrance $R = \frac{P}{2}$.

3. Unlike recessive disease there is only a small increase in risk with consanguinity in dominant conditions (see Table 2).

4. If both parents are affected, one-half of the children will be homozygotes, probably more seriously stricken than the parents themselves; one-half will be heterozygotes of whom $P/2$ are stricken in the same way as the parents. Thus, with complete penetrance, three-fourths of the children would be affected. As a matter of fact this proportion is almost always smaller.

5. If healthy parents already have an affected child, we must first think of a mutation. In this case the risk of the next child being affected would be almost nil. We can, however, also admit a direct transmission by one of the parents, who would then be a latent carrier because of lack of penetrance. These two conditions were taken into account. The first was given a weight nine times that of the second.

$$R = \frac{P}{20}^{\bullet}$$

6. One parent and one child already affected

$$R = \frac{P}{2}$$

7 & 8. One grandparent or one uncle (aunt) affected

$$R = \frac{1-P}{2-P} \cdot \frac{P}{2}$$

Notice that R would be nil if P were 100%, that is, 1.

9. One first cousin affected

$$R = \frac{1-P}{4-P} \cdot \frac{P}{2}$$

R would also be nil if P were 100%.

IV

SEX-LINKED EYE DISEASES

(See Table 3)

Six diseases transmitted through the X-chromosome seem sufficiently important to require a genetic consultation. These are:

• Editor's Note: This weighting is recommended only when further family investigation is impossible or fails to decide between the alternatives.

TABLE 2
DOMINANT AUTOSOMAL EYE DISEASES

EYE DISEASE	Accuracy of Genetic Prognosis ••• accurate •• approximate • very approximate	Penetrance (estimated percentage)	*R* = Risk in % of Next Child Being Affected When– Father or Mother Affected: No consanguinity	Father or Mother Affected: Parents First Cousins	Father and Mother Affected	One Child Affected, Parents Not Affected	Father or Mother and One Child Affected	One Grandparent, or One Uncle or Aunt Affected	One First Cousin Affected
CONGENITAL CATARACTS	••	95	47.5	47.5	73	4.7	47.5	2	0.6
DYSTROPHIA MYOTONICA	••								
HEMERALOPIA (NOUGARET'S TYPE)	•••								
GRANULAR CORNEAL DYSTROPHY	•••								
LATTICE-LIKE CORNEAL DYSTROPHY	••	90	45	45	70	4.5	45	4.1	1.4
FAMILIAL ATROPHY OF THE OPTIC NERVE (different from Leber's disease)	••								
ANIRIDIA	•••	83.5	42	42.2	67	4.2	42	5.9	2.2
GLAUCOMA	•	80	40	40.2	65	4	40	6.6	2.5
NEUROFIBROMATOSIS (Von Recklinghausen)	••	70	35	35.5	60	3.5	35	8.1	3.2
OSTEOPSATHYROSIS (Lobstein)	••								
RETINOBLASTOMA	••	60	30	30.8	55	3	30	8.6	3.5
PTOSIS CONGENITA	••								
EPILOIA (TUBEROUS SCLEROSIS)	••	50	25	26.2	50	2.5	25	8.3	3.6
VON HIPPEL-LINDAU'S DISEASE	••								
CRANIOFACIAL DYSOSTOSIS (Crouzon)	••								
COLOBOMATOUS AFFECTIONS	••								
OXYCEPHALY	••	30	15	17	40	1.5	15	6.2	2.8
MARFAN'S SYNDROME	••								
ACROCEPHALOSYNDACTYLY (APERT)	•	10	5	7.7	30	0.5	5	2.4	1.15
STURGE-WEBER'S DISEASE	(•)								

congenital nystagmus, dyschromatopsia, hemeralopia (recessive type, different from Nougaret's type), choroideremia, Leber's optic atrophy, and ocular albinism (albinism of the eye only).

Sex-linked heredity is characterized by lack of transmission from affected father to son. A healthy male cannot transmit a sex-linked disease, even if the disease exists in the family. On the contrary, any woman related to an affected male may be a carrier of the disease, provided that the relationship is effected through an uninterrupted chain of women.

1. In a healthy family, the risk is very small for a son, and practically nil for a daughter. In order to shorten our table we have omitted to mention it.

2. In a healthy family, the risk is practically the same with or without consanguinity.

3. If one parent is affected, the risk depends upon the parent and the penetrance (P).

a) father affected

$$R\ \delta\ \cong 0$$
$$R\ \varphi\ \cong P$$

if $P = 0$, as in recessive sex-linked affections, $R = 0$. All the daughters, however, will be carriers, able to transmit the disease.

b) mother affected

(1) incompletely dominant diseases (Congenital nystagmus, Leber's diseases)

$R\ \delta = 55\%$.
$R\ \varphi = 55\%.P$

(risk is greater than 50% because the mother may be homozygous).

(2) recessive affections

$R\ \delta = 99\%$.
$R\ \delta \cong 0$

4. Consanguinity can increase the above risk but only if the relationship of the parents is effected through women or through affected males (without interposition of a single healthy male). If, for example, the parents are first cousins, the risk can be increased by consanguinity only if the affected parent is the father and if the relationship is through the mother of the affected father and through the mother of the healthy mother. Under these circumstances consanguinity increases the risk for both sons and daughters (see Table 3). The rather complicated formulae are not developed here for lack of space.

5. If one grandparent is affected, the paternal grandparents cannot transmit the disease through their healthy son. On the contrary the maternal grandparents can transmit the disease (see Table 3).

6. The same for the uncle (aunt).

VI

CONCLUSIONS

The establishment of a prognosis in genetics is more delicate that might commonly be supposed, especially if we wish to take advantage of the progress made by genetics in recent years. It requires a great deal of information which is often difficult to bring together, for example, the frequency of a disease in the population, the rate of mutation, the degree of penetrance, etc. Often there is no precise, published figure in the literature. So we must content ourselves with a personal evaluation, which is evidently somewhat arbitrary. Genetic prognosis requires in addition to all this certain special mathematical procedures which can seem very difficult to those who use them only occasionally.

Faced with this complex problem we decided to establish tables which would be easy to consult and which would indicate immediately the chances of a child being stricken. These percentages have only suggestive value. They can be modified according to particulars of heredity in a specific family. It should also be said that in families theoretical ratios are rarely realized. Each case is subject to the same degree of chance, exactly as if we were to play a slot machine only once.

Without enforcing obligatory measures offensive to human liberty, we think that

TABLE 3

SEX-LINKED EYE DISEASES

EYE DISEASE	Accuracy of Genetic Prognosis ••• accurate •• approximate • very approximate	Penetrance in females (estimated percentage)	*R* = Risk in % of Next Child Being Affected When–					
			Father Affected, No Consanguinity	Mother Affected, No Consanguinity	Father Affected, Father and Mother First Cousins, Relationship through Women Only	Maternal Grandfather Affected	Maternal Grandmother or Maternal Uncle or Aunt Affected	Paternal Grandparents, Paternal Uncle or Aunt Affected
CONGENITAL NYSTAGMUS	••	40	♂ 0.01 ♀ 40	55 22	13 47.7	50 20	25 10	0.01 0.008
DYSCHROMATOPSIA	•••	0	♂ 8 ♀ 0.64	99 0.64	12.5 12.5	50 0.64	25 0.64	8 0.64
HEMERALOPIA (recessive type, different from Nougaret's type)	•••	0	♂ 0.001 ♀ 0	99 0	12.5 12.5	50 0	25 0	0.001 0
CHOROIDEREMIA	••	0	♂ 0.0001 ♀ 0	99 0	12.5 12.5	50 0	25 0	0.0001 0
LEBER'S OPTIC ATROPHY	•••	20	♂ 0.001 ♀ 20	55 11	16 33	50 10	25 5	0.001 0.0004
ALBINISMUS SOLUM BULBI OR SOLUM FUNDI (ocular albinism)	••	0	♂ 0.0001 ♀ 0	99 0	12.5 12.5	50 0	25 0	0.0001 0

[1] The risk is different whether the next child is a boy or a girl. The first number marked with the symbol ♂, is the risk for a boy. The second number, marked with the symbol ♀, is the risk for a girl.

TABLE 4

ALPHABETICAL LIST OF HEREDITARY EYE DISEASES

In our tables we only registered a limited number of diseases sufficiently grave to justify a genetic consultation. In the following list we note also many other diseases. The prognosis of other diseases can then be established by analogy with the diseases chosen in the tables.

EYE DISEASE	MODE OF INHERITANCE D = Dominant R = Recessive S = Sex-linked RS = Recessive sex-linked IS = Intermediate sex-linked, etc.	ACCURACY OF GENETIC PROGNOSIS ••• = accurate •• = approximate • = very approximate
Ablatio falciformis retinae congenita	R	•
Achromatopsia	R	••
Albinismus	R	•••
Albinismus solum fundi or bulbi	RS	••
Alexia	D	•
Aniridia	D	•••
Angioid streaks of the retina	R (D irreg.)	••
Anophthalmia	D or R	•
Apert's syndrome	D	•
Arachnodactyly	D	••
Astigmatism	D	•
Best's disease (Congenital macular degeneration)	D	••
Blepharochalasis	D	•
Cataracta caerula	D	••
Cataracte presenilis	D	••
Choroideremia	IS	••
Choroiditis guttata	D or R	•
Cleido-cranial dysostosis	D	•
Colobomatous affections	D	••
Congenital cataracts (all different forms)	D	••
Corectopia	D or R	•
Cornea guttata	D	•
Cornea plana	D or R	•
Cornea verticillata	D	•
Corneal dystrophy (granular)	D	•••
Corneal dystrophy (lattice-like)	D	•••
Corneal dystrophy (macular)	R	••
Cranio-facial dysostosis (Crouzon)	D	••
Cranio-hypophysal dysostosis (Schüller-Christian's disease)	R?	(•)
Diabetes mellitus	R (or D)	•
Diffuse "epithelial" dystrophy of the cornea (Fuchs)	D	•
Duane's syndrome	D	•
Dyschromatopsia	RS	•••
Dyslexia	D	(•)
Dystrophia myotonica	D	••
Ectopia lentis	D (R)	••
Epicanthus	D	•
Epiloia (Tuberous sclerosis)	D	••
Embryotoxon (Axenfeld's syndrome)	D (or RS)	•
Esotropia	D	•
Exotropia	D	•
Gargoylism	R (RS)	••
Glaucoma	D	•
Glaucoma congenital	R	•

(Continued on next page)

TABLE 4.—(*Continued from preceding page*)

Hemeralopia (Nougaret's type)	D	•••
Hemeralopia (recessive type)	RS	•••
Heterochromia (Fuch's type)	D	•
Heterochromia simple	D	••
Heterochromia sympathetic	D	•
von Hippel-Lindau's disease	D	••
Hypertelorism	D	•
Infantile amaurotic idiocy (Tay-Sachs)	R	••
Juvenile amaurotic idiocy	R	••
Keratoconus	D or R?	•
Laurence-Moon-Biedl syndrome	R	••
Leber's optic atrophy	DS	•••
"Leventinese" malattia	D	••
Mandibulo-facial dysostosis (Franceschetti-Zwahlen)	D	••
Marcus Gunn's syndrome	D	••
Marfan's syndrome	D	••
Microphthalmia	R, D or RS	•
Mongolian idiocy	D	•
Myopia (high)	R	•
Neurofibromatosis (von Recklinghausen)	D	••
Nystagmus (congenital)	S	••
Oguchi's disease	R	••
Osler's disease (Telangiectasis)	D	••
Osteopsathyrosis (Lobstein)	D	••
Oxycephaly	D	••
Pterygium	D	•
Ptosis	D	••
Retinitis pigmentosa	R (rarely D or RS)	•••
Retinitis pigmentosa sine pigmento	R	••
Retinitis punctata abbescens	R	••
Retinoblastoma	D	••
Retinoskysis peripheral	RS	•
Rothmund's syndrome	R	•
Schüller-Christian's disease	R?	(•)
Sturge-Weber's disease	D	(•)
Werner's syndrome	R	•

every physician has occasion to contribute by his advice to the betterment of the human race.

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FAMILY POLICY IN FRANCE

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FRANCE'S FAMILY POLICY HAS BEEN one of her most unusual characteristics for the last 15 years. The idea of a family policy, directed by the State, contradicts the individualistic traditions of the French people for whom the family represents the natural sanctuary of their privacy.

Today, however, about 1,300 billion francs, or 9 per cent of the national income, is allotted by the government to the annual budget for family relief measures. To explain this enormous collective effort, we should look first into the basic principles of family policy before examining its methods and evaluating its first results.

The Foundations of Family Policy

The French experiment is guided by three main principles: a demographic concern, a search for social justice, and a psycho-sociological objective.

The Demographic Goal—During the years of international tension after World War I France became aware of the gravity of the demographic situation. From 1920 to 1939 the population rose about 7 per cent, which was only one-half that of Germany and of Italy and one-fourth that of Eastern Europe. In 1939 the Code de la Famille, the plan to aid the economic condition of the French family and thus raise the birth rate, was passed.

Social Justice—The State also set itself the task of making social justice prevail. Industrialization had taken away from the family its economic function since before the lawful regulation of child labor, children brought their wages home. After child-labor laws were enacted, the family resources tended to dwindle, especially since the education of children became more and more expensive.

The idea of compensation for child dependents rapidly gained ground, even in countries with a predominantly capitalistic concept, as in the United States and Switzerland. The institution of family allotments in twenty-five countries under different forms and to varying degrees is proof of this, and in 1947 it received its sublimation with the declaration of human rights in Article 23: "Whoever works is entitled to an equitable and satisfying remuneration, assuring him, *as well as his family*, an existence that conforms with human dignity, and to be completed, if possible, by all the means of social protection."

The French law stems from the same concept; the compensation of family dependents is inspired not from the idea of social charity but from that of justice. It tends toward the redistribution of the national income by permitting everyone who works to found a family, with assurance of provision for the main needs of his family. This redistribution is even more necessary because the general wage level is rather low.

Psycho-Sociological Aspects—Social and demographic aspects, however, give only a partial view of the family policy, which is dominated by ideas that have evolved mainly since the beginning of the century. The experiment of the Soviet Union in this field shows that predictions about free union and collective upbringing of chil-

dren have turned out to be erroneous. Sociologists, geneticists, pediatricians, and psychiatrists agree that the family unit, as a social cell as well as an educational environment, represents certain irreplaceable sociological values. On the international scene the studies of Spitz in the United States, Mme. Aubry Roudinesco in France, Bowly in England, and of many others further confirm that the family environment is indispensable for the normal development of the child and that it constitutes the "chosen ground of human growth." "At one time I believed, "declared the biologist Jean Rostand, "that the child could live by being taken away from its family and could be raised by the State. Today I don't believe this any more after the experiments that have been made."

Therefore, once the danger of depopulation was averted, the demographic aim shifted imperceptibly to preoccupations of a social and moral character. The preamble of the French constitution of 1946, as well as the universal declaration of the rights of man follow this trend of thought, with the latter emphasizing that "the family is the natural and fundamental element of the society and has a right to be protected by the society and the State."

Chief Characteristics of Family Policy

The main trend of action of public authorities is reflected in the different family institutions.

A New Trend in Social Policy—Family policy is not an independent element superimposed on social policy. The latter takes the reality of family life into account. The protection of the worker, of the pregnant woman, of the child, etc., is regarded as the protection of these individuals as members of a family unit. Yet this protection is not aimed at the individual but is centered on the whole family. On the other hand, it is based on the realization that solutions given to great social problems, such as a minimum living standard, taxes, housing, Social Security, education, must necessarily have an influence on living conditions, family structure, fertility, and stability of a family unit. Such is the meaning of the welfare program as carried out in France. Principles, methods, and habits of the traditional social program have a continuous trend toward a new objective. This tendency demands a sustained impulse and a constant coordination, and it justifies the existence of organizations on the various levels in charge of defining and defending the interest of the family.

In the State Secretariat for Public Health and Population it is the main task of the "Sous-Direction de la Famille" to encourage and coordinate the activities of public administration (Social Security, farmers' aid, housing, education, taxes, etc.) and of private organizations working toward the founding of a family. Under the same secretariat the National Institute of Demographic Studies supplies responsible authorities with the scientific premise for their actions in the field of demography and sociology. This is accomplished through its publications, *Population* and specialized magazines.

The Respect for Private Life—On the other hand, respect for the family, for its autonomy and its freedom, is also characteristic of the French policy which is a policy of protection, without interference or oppression. Since 1939 no government has been tempted to yield to a control of the family as in certain totalitarian states. While family subsidies show a slight concern for an increase in birth rate—a concern which is perfectly legitimate for a government mindful of its future—the legislator avoids exerting pressure. He limits himself to helping only the head of the family in maintaining the home which he freely established. The origin and development of this home depend upon the sole conscience of the head of the family. Public welfare does not replace the parents. It only endeavors to stimulate their educational responsibilities. We can thus understand the preference given to financial as-

sistance, which the head of the family can dispose of freely, in contrast to assistance in kind.

The importance given to family organizations in public institutions proves that the State does not want to place the family under its tutelage. In addition to the family aid the government established the formation of an organized family unit. Thousands of family associations with varying jurisdiction and of every social milieu have grouped themselves into unions of family associations which are in charge of representing all the French families before public authorities and ensuring them the rendering of family services. Like syndicates, these unions can especially act as the voice of the family in the Economic Council, in the "Commission Superieure des Conventions Collectives," in the organs and councils of Social Security and Family Allotments.

Family Allotments—Among all the measures of compensation for dependents, family allotments occupy a very outstanding place in France. The right to allotments is not limited by the amount of income nor do the allotments increase with the income of the recipient. Between maximum uniform subsidies or subsidies decreasing with income and subsidies proportioned to salary, the legislator has chosen a system of equal allotments for all, a system which is satisfactory with few exceptions.

However, in no case does the French legislature aim at the entire leveling of family subsidies. The family representatives themselves think that an exact leveling, besides being impossible to determine, would risk stultifying the worker's desire for bettering his professional qualification and that it would be an unbearable burden on the economy. From the point of view of family morals it would weaken the sense of responsibility of the head of the family.

Theoretically, anyone with dependents to care for has a right to family subsidies. However, except for prenatal allotments, the law requires that the head of the family be working or that he prove his inability to be employed.

The subsidies are calculated in relation to a basic monthly salary, varying with the locales (at the present time 18,000 francs in in the Seine department). They were to have followed the movement of salaries and prices according to the cost of the living index clause which was included in the law of 1946. This generally could never be applied, but periodic readaptations have luckily enough played the same role, due to the method of financing through monthly payments in proportion to salaries.

Main Family Subsidies. 1. Family allotments granted to people who have at least two children to care for are calculated upon the basic salary, 22 per cent of this salary for two children, 33 per cent for the third and for each following one. Since 1955, an increase equivalent to 5 per cent of the salary is granted for each of the children over ten years, with the exception of the eldest. To these family allotments is added an adjustment which was enacted in 1948 when the tax, which was withheld from the salary every month, was repealed. Without this adjustment the tax repeal would have favored bachelors and not families with children, the former paying but a reduced tax or no tax at all.

2. The allotment of a single salary is granted to persons or households which fulfill a double condition: a. to be engaged in a remunerative professional activity, (or to be unable to work after the interruption of a remunerated activity or to be a widow of a salaried person); b. to benefit from a single professional income coming from the salaried activity of either husband or wife or of a free union between a man and a woman.

From the economic point of view, the allotment of a single salary, the rates of which vary from 10 to 50 per cent, does not seem to have had a statistically measurable influence on the professional activity of married women.

The allotment of the single salary represents 35 per cent of the family subsidies of the salaried and non-salaried people and the family allotments and adjustments of 1948 represent 60 per cent.

4. The pre-natal allotments from which any woman can benefit have a triple aim: social, demographic and health. They were enacted in 1946 and are linked to the legislation pertaining to the protection of the mother and the child. The monthly payment is calculated at the rate of 25 per cent of the basic salary and meets the special conditions.

5. Maternity allotments are granted at the birth of each child of French nationality, born living and legitimate or recognized. For the first birth the allotment amounts to twice the monthly salary of the highest basic monthly salary of the department, and for the following births the rate is one and one-third of the same salary.

6. The housing allotment takes a separate place at the crossroads of the allotments for family dependents and housing policy.

Other Forms of Social Protection of the Family

Next to family subsidies which tend to ensure a regular addition to the income of the head of the family, several compensational measures aim at either giving him financial help in certain extraordinary circumstances or at lessening the family burdens by the reduction of tariffs or other financial obligations; for instance, families with many children benefit from advantageous rates for railroads and transportation. In the same way social insurance covers the members of the salaried person's family without increase in the monthly payment. Income tax, applying the "quotient familial," *i.e.*, the size of the family, takes the latter into consideration by reducing the income of the taxpayer to an average income by means of units of consumption and taxing each of the latter individually.

Social redistribution of resources has limitations and creates for the head of the family a handicap which might force him to sacrifice some elements essential to the material and mental well-being of his home. In this instance, assistance in kind must complete the effectiveness of monetary subsidies. This complementary effort of public welfare requires an appropriate social action which still has to be developed further: proper housing and social services for the family, special housing facilities for vacations. A staff of social workers especially trained is thus required.

Results

Considering the strength of the methods used, it is not surprising that French family policy has registered tangible results from the demographic as well as the social point of view.

The increase in the birth rate in France surpassed the most optimistic anticipation. Demographers compared the increase in birth rate in France since the last war with that of their own countries and sought to isolate the effect of family subsidies. They believe that the new legislation exerted a lasting influence upon the fertility of present generations. For this reason, if the birth rate is to be maintained at its present level, the measure of aid to the family must not be lessened.

The improvement of family conditions, from the point of view of social justice, has been accomplished by a redistribution of incomes. Today the laborer with four children who is paid 30,000 francs a month and whose wife is not working doubles the amount of his individual pay.

The evolution of opinion about family and birth problems was just as fast. The political parties and unions with communist and socialist tendencies, who were at first reticent, later were all in favor of family policy. The Charter of 1946 was voted for unanimously and the opposition, often the prey of Malthusian fears, represents an infinite minority.

Looking into the Future

Although the institutions of social protection for the family deeply affect the France of today, one cannot assert that they have reached the last stage of their development. Imperfections remain in the field of family compensation. As far as the tax is concerned, the "quotient familial" is only applied in a limited scope. Marriage loans, practised by a few organizations, must become general. Family subsidies are bound to make new progress: effective application of the cost of living index, adjustment of rates, reformation of the single-salary allotment. The housing subsidy seems to be destined to increase quickly, owing to the speed of construction. It seems that all efforts must be placed in the field of social facilities: development of schools for home economics, construction of vacation housing for families, increase in the number of specialized social workers, and establishment of marriage counseling centers.

The results already encourage public authorities to intensify the course. What is more, the influx of young generations creates new needs which hasten the primary plans of facilities of the post-war period: construction of schools, vocational centers, housing units, sport fields and working places. With the demographic progress and rebirth of the French family, France is experiencing a renascence which will lead her to choose a plan for economic development.

A CONTRIBUTION TO THE GENETICAL DEMOGRAPHY OF NORTH SWEDEN

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I

THE THEORY OF ISOLATION PLAYS AN important role in modern neo-Darwinistic thinking, especially for the understanding of micro-evolution and race formation. The commonest and, from a bio-geographical point of view, most important type of isolation is geographical. One approach to this problem is to study the incidence of marriages between individuals from adjacent populations. The frequency of marriages in which both partners are from the same region is correlated with the mobility of the population and the degree of geographical isolation.

Investigations concerning cousin marriages, marriages between adjacent regions, and migrations are very difficult in the Scandinavian countries and require original field work and the collection of church register data from many different parishes.

The files of the large anthropometric survey "The Racial Characters of the Swedish Nation" contain information about the birthplaces (parishes) of both parents of most of the examined conscripts. These data were used only for the grouping of the material into, *e.g.*, rural or urban communities. This extensive material collected over a period of several years should give a good opportunity to study regional variations of isolation. I have therefore used these data for an investigation of the problem as outlined above with reference to the county of Norrbotten.

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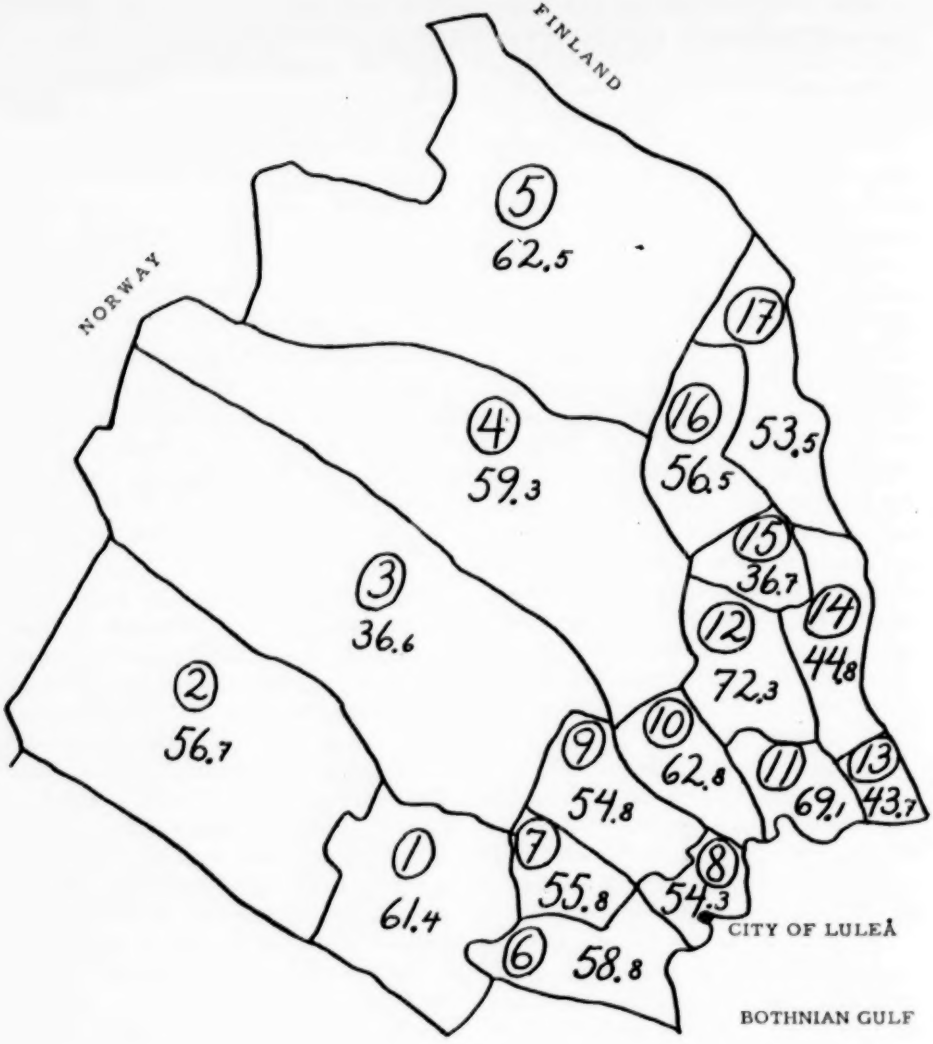
The county of Norrbotten covers approximately one-fourth of the total area of Sweden. It is the most sparsely inhabited county of Sweden with an average of about 3 inhabitants per square km. About 65 per cent of the Lapps and 95 per cent of the Finns of Sweden live within this area.

II

To the original material from "The Racial Characters of the Swedish Nation" further data of about 1,000 conscripts were added. These individuals were examined by the late Professor H. Lundborg after the publication of the large survey, and the results have not been published before. The material does not include marriage data for the Lapps since these were not enlisted in the army at that time. As the material deals with marriages between parents of young men who underwent their military service in 1923-24, it can be said to reflect conditions at the turn of the last century.

The parishes have been grouped into 17 regions. Because of the smallness of some of the parishes a number of them had to be joined into larger suitable units.

To obtain a measure of the relative isolation of the different regions, the number of marriages with both partners from the same region have been calculated in percentages of the total number of marriages with at least one partner from the region in question. The result is shown in Table 1 and in Figure 1. A high value should correspond to a high degree of isolation.



Regions 10, 11 and 12 display the highest values. The lowest values were found in region 3 and in regions 13, 14 and 15 of the eastern part of the county.

The variation between regions was examined by means of the following heterogeneity test (Fisher, 1948):

$$x^2 = \frac{1}{\bar{p}\,\bar{q}} \left(S\,(ap) - n\bar{p}\right);$$

where $\bar{p}$ is the percentage in the whole sample, p the percentage in the partial samples and n the absolute number of marriages with both partners from the

TABLE 1

NORRBOTTEN

NO.	REGION	a BOTH PARTNERS FROM THE SAME REGION	b ONE PARTNER FROM ANOTHER REGION	c TOTAL	% 100 a / c
1	Arvidsjaur	102	64	166	61.4
2	Arjeplog	38	29	67	56.7
3	Jokkmokk	32	56	88	36.6
4	Gällivare	80	54	134	59.3
5	Kiruna, Karesuando, Jukkasjärvi	50	30	80	62.5
6	Piteå landsk., Norrfjärden, Hortlax	207	145	352	58.8
7	Älvsby	77	61	138	55.8
8	Nederluleå, Luleå stad	114	96	210	54.3
9	Boden, Edefors, Överluleå	182	124	306	54.8
10	Råneå	140	83	223	62.8
11	Nederkalix, Töre	156	70	226	69.1
12	Överkalix	122	47	169	72.3
13	Haparanda, Karl Gustav, Nedertorneå	55	71	126	43.7
14	Hietaniemi, Övertorneå	64	79	143	44.8
15	Korpilombolo	18	31	49	36.7
16	Junosuando, Tärendö	39	30	69	56.5
17	Pajala	54	47	101	53.5
	Both parents immigrants to Norrbotten	177		177	
	One parent immigrant to Norrbotten		265	265	
	Totals	1,530	1,117	2,647	57.8

same region in the total sample. The value of x^2 is 27.5 with 16 degrees of freedom, which gives a significance level of $0.05 > P > 0.02$. Most of the parishes have a frequency of *intra* marriages, which is higher than 50 per cent. The mean for the whole material is 57.8 per cent.

The *inter*-regional variations coincide roughly with two different areas which were presumably more broken up as isolates, one area consisting of regions 3, 8 and 9 and another area consisting of regions 13, 14 and 15. These areas are the most likely migration passages of the county: the eastern area for exchange of people with Finland and the western area as a main passage westward along the river Lule.

III

The following correlations between the parameters mentioned above and the anthropological and demographical features of Norrbotten county as well as natural barriers and passages are of further interest.

Flodström (1915) has demonstrated that in the beginning of this century region 3 (the parish of Jokkmokk) had a lower fertility than the rest of the county.

Recent detailed rearrangement of the primary material of the large Swedish anthropometric survey "The Racial Characters of the Swedish Nation" has shown that about 1925 region 3 had a lower cephalic index than the surrounding regions (Beckman 1956). This indicates a Nordic introgression into region 3.

In a blood-group investigation of about 8,000 conscripts from this county it was found that the A-gene showed a significant heterogeneity in the regional distribution (the same regions as in this investigation were used). Region 3 also deviates from the surrounding regions inasmuch as the A-gene frequency is lower. As the Lapps who have high A-frequencies presumably

were the original settlers of the county, the regions with relatively high A-frequencies should be the oldest and most isolated ones. They should have had the least introgression from the Nordic and East-Baltic races. The low A-frequency in region 3 indicates an isolate-breaking immigration from the Luleå area, which is known to be relatively Nordic (Lundman 1946).

Bylund (1956) mentions that the river Lule gives good opportunities of traveling to the inner parts of Norrbotten. The river Kalix on the contrary is pointed out as a difficult passage for migration, and the southern areas have had bad communications.

The eastern area is connected with other good water passages, namely, the rivers Torne and Muonio. Here the average stature is considerably lower than in the rest of northern Sweden and similar to adjacent Finland (Lundman 1946). The regions 13 and 14 are the only ones in the county of Norrbotten which have B-gene frequencies higher than 10 per cent, thus indicating a relationship with Finland, which has frequencies that always exceed 10 per cent (Beckman 1956).

Thus the frequencies of *intra-* and *inter-*marriages, respectively, seem to agree with other observations insofar as they appear to fit into a pattern which may explain some of the evolutionary features of the population of this area.

As mentioned above, the average frequency of *intra-*parish marriages for the whole county was 57.8 per cent. Presumably most of the regions should be considered as isolates in or about 1900.

Special investigations by Böök and Kostmann (1956) indicate that at least parts of regions 16 and 17 and region 12 constitute geographical isolates.

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POPULATION PROBLEMS AND FAMILY PLANNING IN JAPAN

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I

The population problem in Japan has reached a very critical stage. However in some quarters it is held that family planning has nothing to do with population policy. In a sense this is true, but it is natural for a country with a very serious population problem to wish to promote family planning from that standpoint.

The most significant question in Japan's population problem is whether the present industrial development and the future scope of foreign trade will be sufficient to support the rapidly growing population. The total population of Japan in 1955 was already over 89 million. In comparison to the pre-war population this increase is approximately equal to the total population of six prefectures in the northeastern part of Japan.

Why has this rapid expansion occurred? It is due to the high birth rate and the sudden drop in the death rate which occurred after the war. The birth rate in Japan showed a sudden rise after the war: 34.3 per 1,000 in 1947. On the other hand the death rate showed a rapid drop. Before the war the death rate did not go below 14 or 15 per 1,000, but in 1955 it dropped to a low of 7.7. Owing to the introduction of high-standard techniques in public health from the United States—especially the importing of antibiotics for use in therapeutic medicine—deaths from pneumonia, communicable diseases, and tuberculosis markedly decreased, and such diseases had formerly been the leading causes of death in Japan. As a result severe population expansion has occurred. Estimates indicate that the population of Japan will reach 100 million in 1970.

When we look in more detail at the change in age composition from the present to the future, it indicates a striking phenomenon. First we shall estimate the population composition by age groups in 1960. The total population will be about 94 million. Considered in terms of age, the population below 15 years of age will decrease to 27 million, but the labor age population between 15 and 59 years of age will increase to 58 million. The population over 60 years of age will be about 8 million. In these changes the most important problem we have to face is the increase of the labor age population.

Furthermore, in 1970—ten years later—what will happen to the age composition of the population? According to our estimates the total population will then be 101 million and the labor age population will have increased further to 68 million, an increase of 10 million from 1960. On the other hand the population below 15 years of age will have decreased to about 21 million, and the old age population will have reached about 11 million.

The decrease in the population below 15 years of age is a real problem in these estimates for 1970 as is the increase in the old-age group. However, most important of all is the increase in the labor-age group, which is about 10 million every 10 years or 1 million each year. The most serious problem here is how to provide jobs for the rapidly increasing labor group. According to a recent official announcement of the Ministry

of Labor, there are 750,000 wholly unemployed and almost 5,000,000 partially unemployed persons even now. To find jobs for this steadily increasing group year after year poses a serious problem. Of the 1,000,000 increase each year, 300,000 are girls who will get married, which leaves 700,000 for whom new jobs must be provided each year. Will it be possible to do this? The prospect of such great increases in the number of unemployed each year is to be dreaded. Every one should recognize the danger of having such a large mass of hungry people in a country.

II

Family planning is ensuring a prosperous and happy family in the future by having a reasonable number of children. This movement started in Japan actively toward the end of the war. However, small movements to promote family planning have existed for quite a long time, and much hard work has been done by people who have introduced this movement from abroad. Although the necessity for family planning was known, the idea was not seriously considered by the Japanese Government because the limitation of the number of children is a very delicate problem connected with fundamental rights in the national constitution. Therefore the overwhelming opinion of government leaders was that the government should not deal with this question.

However in 1949, the government reached the point where something had to be done about the problem, and in June 1949 a Council on Population Problems was established in the Cabinet. The Council studied various counter-measures concerning population policy and brought out strongly the need of birth control. Unfortunately the recommendations were not considered carefully, and the Council was abolished within a short time.

But, fortunately or unfortunately, the public began to practice birth control without any relation to government direction. One of the biggest reasons for this practice was the difficulty of having a satisfactory married life owing to the shortage of houses especially in cities where war damage was severe. Although war damage was much less in the rural districts, it was difficult for people to have children as freely as they desired because of such conditions as the return of a large number of repatriates from abroad or two or more families living in the same house. Under such circumstances the general public began to practice birth control voluntarily, and, to our regret, the great part fulfilled its purposes by induced abortions. Just at that time the Eugenic Protection Law was amended, whereby induced abortions were no longer regarded as crimes. In this way abortion increased rapidly; in 1950 the total number of abortions was 490,000 and reached 1,140,000 in 1954. These figures are only for the reported cases, and if the abortions performed secretly or unreported were added the total is estimated to be about double the reported number, in other words over 2,000,000 in 1954.

It has been mentioned previously that the birth rate showed a sudden drop within the last seven or eight years. Most of the demographers in this country believe that this remarkable decrease was caused by and large by the performance of induced abortions. On the other hand the increase in induced abortions led to recognition that such operations were dangerous for mothers. For example, according to the investigation of the Gynecological Association in 1949, there had been 76 deaths from 40,000 operations for induced abortion. In addition there were over 260 serious complications and a still larger number of minor health hazards such as abnormal bleeding or anemia. These results could not be overlooked and became a serious problem from the standpoint of public health.

When Mr. Ryugo Hashimoto, the then minister of Health and Welfare, visited the Institute of Public Health, I showed him these figures and said that something must be done about the situation. Although Mr.

Hashimoto was of the opinion that birth control should not be practiced from the standpoint of population policy, he was struck with the statistics and agreed that the problem should not be left untouched. He felt that it was an important humanitarian as well as public health problem and that conception control must take the place of induced abortion which had become so prevalent in the nation. Finally this point of view became the official decision of the Cabinet on October 26, 1951, a day which I can never forget. As a first step the Japanese government took counter measures concerning this situation as part of the national policy. Thus at first it was not considered a population policy but was taken up from the standpoint of maternal protection. However, this has changed; today it is recognized that this movement should be promoted as part of a population policy. This idea is based upon the recommendations made by the Council on Population Problems which was lately established according to the Welfare Ministry Establishment Law, 1954. The government changed its attitude and held that the practice of birth control or family planning is absolutely necessary throughout the nation in order to prepare for or at least to mitigate the danger of unemployment. Some said that the practice of birth control at present would not help to solve the problem of unemployment because the people who would lose their jobs in the near future had already been born. As a member of the Council I used to explain to such people that unemployment was not just a problem of the unemployed person but also of his family. We need to think what a tragedy it will be if the breadwinner of a large family is out of a job.

There are few now who oppose the family planning movement even in the political field. So far as the people at large are concerned, most of them are cooperative. Even in the purely agricultural districts, for example in Yamagata or Akita Prefecture, farmers are no longer thinking that it is better to have as many children as possible, which they used to say before. It is true that agriculture cannot exist without the help of children, especially in the busy season when farmers need "the hands of a cat." But today farmers are beginning to recognize that too many children are a cause of trouble later. The results of various investigations show that most of the people wish to have three children on the average even in the agricultural districts. These changes were greatly influenced by economic circumstances in these years. Before the war the eldest son succeeded to the family property and other sons were able to get their living by working outside in factories, etc. Needless to say, things do not go so easily today.

Another big problem is the system of equal inheritance legalized by the new constitution after the war. A few years ago, when we held a round table discussion with the farmers at Akita Prefecture, I asked an old woman how many children she wanted. After long consideration she answered that she would want about five. This woman had 15 tan (about 4 acres) to cultivate. Later when we talked about equal inheritance, I asked this woman whether she thought 3 tan sufficient for each child if she had five children. Of course that would not be sufficient, she said. All the farmers then began to think seriously about the matter. Recently, however, even the farmers in the purely agricultural districts began to think seriously about family planning. I am sure there are few who want to have three or more children among the younger generation who are about to start their family life. Incidentally, most of the couples in cities do not want to have more than two children these days.

III

Next I would like to say a little about our experiences in the agricultural villages and coal mines where we have worked, using these districts as test districts for family planning. Six years ago I started the

guidance in family planning at Minamotomura in Yamanashi Prefecture, and at Kamifunaka-mura and Fukuura-mura in Kanagawa Prefecture. These places represented the farming village in the mountainous district, the rice-farming village in the plain, and the fishing village. Guidance has been given continuously in these three typical villages. Quite good results were obtained after six years' work. Not only did the birth rate drop, but the number of induced abortions also decreased. I talked about these facts to people in the government and suggested various points in guidance and education that would contribute to the government program of family planning.

However, some people said that it was more difficult to give guidance to laborers than in the rural villages. Their opinion was that guidance among laborers was more desirable, especially in the coal mines where many children were common. Others felt guidance was more important among the indigent group who, however, do not think seriously about planning their children.

We chose the Joban Company as a coal mine and 12 districts of Katsushika-ward within Tokyo as a model of needy families protected under the Public Relief Law. In three years that have passed, the guidance in these areas has been very successful. The birth rate has decreased greatly and the number of induced abortions also. Induced abortion increased a little when we started our birth-control education. However, due to our continuous guidance it has decreased to one-third of the national average. We were very pleased with such success because we thought we could show our way of guidance to the government people which would lead to a decrease in birth rates without raising the number of induced abortions.

Every year in June I gather all the housewives together and talk to them about the results of the campaign during the previous year. Recently I explained to the wives in Joban by showing them calculations on how economic savings could be made and how the standard of living in each family could be higher if the birth rate continued to decrease at the present pace. When a child is born, 1,000 yen is paid to the family as a delivery allowance in this mine. Also 300 yen is paid as a family allowance every month from the birth of the child until he becomes 18 years of age. This allowance constitutes quite a sum of money over a period of 18 years. How much would the the coal mine save if it did not have to pay these allowances? In the Joban coal mines there are about 7,000 families, and if the birth rate is to drop at the present pace the company will have saved 300,000,000 yen in 10 years. And the expenses which must be borne by the miners themselves in raising their families would decrease by 1,500,000,000 yen. This amount may not necessarily remain as a deposit in the bank but will provide increased expenses for better nourishment or be used in educating the children or in clothing them. It will also raise the level of living for housewives.

Mr. Kawasaki, the Minister of Health and Welfare, made a visit to the coal mine some time ago, and I accompanied him. Members of the House of Representatives from this district joined the party, and sevral senior staff officers of the company were present. The party became too big, and when the round table discussion was about to begin the housewives became so nervous that they did not speak out. I told them not to hesitate, for the purpose of the Minister's visit was to hear frank expressions of opinion from them. Then they began to talk as freely as ever. One of the wives said that when her husband came home drunk he did not care to use conception control, and that in such instances she withdrew. Another woman was appreciative of the guidance because she felt at ease not worrying about a baby she didn't want. She had been worrying about having another child at the time of her husband's retirement, which

was 55 years old in this particular mine. In other cases the children's attendance at school was much better for they did not need to stay home to look after their small brothers and sisters; the attendance rate at the parents-teachers meetings was also much improved. The Minister of Health and Welfare was very pleased and stated that he was deeply impressed.

Conclusions

The number of induced abortions decreased to one-third of the highest amount, and the birth rate dropped to 9.7 in the third year which may seem too low as compared with the whole of Japan, which is 19.3. Some may feel anxious about this drop and feel it is too low, but there is no need to worry about it. These people have already had many children, so the drop in birth rate in recent years does not necessarily mean that the family size has become too small.

This experience in various test districts of actual guidance in family planning has been reported in detail to the government. I think it has contributed greatly in encouraging the family planning campaign by the government now under way throughout the country.

COMMENT

Medical Arts Congress at Turin: With International Symposium of Medical Genetics

The Third International Congress of Medical Arts, sponsor of a number of specialized international symposia including one on Medical Genetics, was held June 1-9, 1957 at the Valentino Exposition Hall in Turin, Italy. The congress was conducted with laudable proficiency and on a grand scale, and took place in a most dignified and beautiful setting. The various sessions were exceedingly well attended by professional men from all over the world, including sizeable contingents of medical specialists.

In addition to Medical Genetics and Statistics, Mental Hygiene, and Social Psychology, the following subjects were covered by well-organized symposia: History of Medicine; Vestibular Function; Physiology; Cardiovascular, Plastic and Orthopedic Surgery; Photobiology; Pharmacology and Chemotherapy; Parasitology; Dermatology; and Nuclear Medicine. Particular emphasis was placed on those fields where important recent advances had occurred. Generally speaking, it was an extremely timely congress, with discussion of all subjects on an uncommonly high level of competence.

From the standpoint of human genetics, the congress meant a remarkable step forward, for it was one of the first times that genetics was officially recognized as one of the important medical specialties. Speakers went out of their way to accord this new discipline the deserved position of equality, thus bearing witness to the fact that medical genetics has finally attained a real place in medicine.

Two developments seemed to have mainly been responsible for this salute to human genetics. First was the discovery that the specificity of blood groups depended on gene action. Second was worldwide recognition of the serious threat posed by radiation and the danger of mutations. Suddenly, people appeared to be aware everywhere that radiation and radioactive fallout may cause mutations leading to pathology.

A highlight of the program was the conferring of honorary medical degrees by the School of Medicine of the University of Turin. At a ceremony conducted with characteristic Old World charm and tradition, the progress of medicine in a number of diverse areas was celebrated and applauded. It was an event long to be remembered by those present.

The illustrious company of six scientists so honored, among whom the writer was privileged to be numbered, were George de Hevesy of Stockholm, Nobel Prize laureate and pioneer in nuclear medicine; Charles B. Huggins of Chicago, hormonal treatment of cancer; Franz J. Kallmann of New York, psychiatric genetics; Jonas E. Salk of Pittsburgh, polio vaccine; Paul Santy of Lyons, cardiovascular (mediastinal) surgery; and Arthur Stoll of Monaco, alkaloid chemistry.

Against this impressive medical backdrop the two-day symposium on medical genetics was held, under the chairmanship of Luigi Gedda of the University of Rome. The meeting was devoted primarily to a discussion of the genetic aspects of tuberculosis and cancer, the morning session of the first day being given over to tuberculosis, with individual papers presented both afternoons.

Participating in the symposium on genetically determined variations in resistance to tuberculosis were F. J. Kallmann, L. Gedda, G. L'Eltore of Rome (on familial accumulation), and F. Keiter of Hamburg (polygenic mode of inheritance).

This reporter emphasized that despite remarkable advances in controlling tuberculosis, neither the question of causation nor the problems of prevention and treatment can be regarded as solved. The recent

decline in the prevalence of the disease has lagged behind that in mortality, and little is known about the nature of gene-specific variations in antimicrobial defense mechanisms. The theory of a polygenic basis for variable resistance to tuberculosis was shown to be supported by all available serial twin data (1 Argentine, 1 North-American and 3 European samples with a total of 698 index pairs) and to be fully compatible with giving recognition to all medical services directed toward attacking the tubercle bacillus. In fact, "reluctance to recognize the operation of any genetic elements in this disease may have such disadvantageous consequences as (1) delay in the search for definitive biochemical correlates of gene-specific deficiencies determining low resistance to tuberculosis; (2) hazardous increase in the number of low-resistance carriers with a chance of reproduction, expected as the result of assortative mating trends and improved medical techniques; and (3) further increases in the mutation rate of populations, due to excessive use of ionizing radiation."

The topic for the second day was the genetic aspect of cancer, with the following research workers participating in the discussion: G. Gianferrari (moderator), G. Arrigoni, P. E. Beolchini, A. Bonino, A. Cresseri, A. Lovati, G. Morganti, A. Musini, M. G. Ronzoni, A. Serra, and G. Torrioli-Riggio. In the afternoon session, A. Bedina, B. DeMaria and R. Peruzzotti joined the panel speakers in presenting blood group data in relation to cancer and other conditions.

Although a uniform set of statistical procedures was used by the investigators, the statistical data concerning a demonstrable genetic component in the etiology of various forms of cancer were inconsistent. Statistically significant evidence for a tendency to familial incidence was obtained in regard to leukemia as well as to cancer of the breast, uterus, prostate and stomach, but not for cancer of the bladder. The meaning of the statistics presented was discussed at length and by an impressive array of prominent experts. One of the unresolved questions was whether the quality of the raw data was sufficiently homogeneous for the application of complex statistical methods.

The somewhat inconclusive tenor of this session drove home once again how much more we need to know in order to be able to understand statistical genetic data. It was revealing to observe the humility and scientifically detached attitude of dedicated research workers who had spent a lifetime at their work in the difficult field of human genetics.

Of the various papers read in the afternoons, those of particular interest here included reports by R. Turpin (genetic risks of radiation); L. Gedda and F. Gentili (prenatal diagnosis of anencephaly in one twin); M. Lamy *et al.* (relationship between the Bonnevie-Ulrich and Turner syndromes); and F. van den Bosch (a newly observed syndrome distinguished by an association of intellectual, ocular and dermatologic defects with a still undefined metabolic dysfunction).

Technical arrangements for translation and transmission of speeches were about as fine and well-organized as any this observer has found anywhere. An excellent loudspeaker system carried the voices of the translators, seated in individual cubicles, to all parts of the large hall. As it happened, there were relatively few English-speaking participants.

Italian warmth and hospitality, as manifested throughout the congress, left nothing whatever to be desired. Similar genetic symposia should be held regularly in other parts of the world. All the papers presented at this symposium will be published in a forthcoming issue of the *Acta Geneticae Medicae et Gemellologiae.*

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BOOK REVIEWS

BIOCHEMICAL INDIVIDUALITY: THE BASIS FOR THE GENETOTROPHIC CONCEPT: Roger J. Williams, John Wiley & Sons, New York, 1956, 214 pp.

This is an interesting and provocative book which deserves to be read by biologists, medical research workers, clinicians —in fact by anyone interested in the human condition for it brings together in a creative and stimulating way a number of concepts from biochemistry, genetics, medicine and taxonomy.

The author begins by pointing out the fantastic degree of individual variation between human beings in anatomy, metabolism and chemical composition and shows the difficulty of defining the "normal." "If 0.95 of the population is normal with respect to one measurable item, only 0.902 $(0.95)^2$ would be normal with respect to two measurable items and 0.60 $(0.95)^{10}$ and 0.0059 $(0.95)^{100}$, respectively, would be normal with regard to 10 and 100 uncorrelated items." Since there are many more than one hundred measurable items, everyone is a "deviant" in several if not many respects.

These individual variations have a genetic basis. Happily, Williams' genetics is sophisticated and not that of the bean-bag school. He is familiar with "leaky mutants" in Neurospera and he comes to the conclusion that genetic variation is continuous rather than discontinuous. He emphasizes that "The characteristics that an organism possesses are fundamentally the outcome of the interaction of heredity and environment." This leads him to formulate what he calls "the genetotrophic approach:" " . . . it should be possible, theoretically at least, to meet the needs of almost any developing ovum, even though these needs are unusual, *provided the needs are known*." These needs are nutritional. By studying biochemical variation and finding what deviations are correlated with specific syndromes, we should be able to ferret out the nutritional deficiencies responsible for the deviations. We could then learn how to relieve the disease by eutrophic measures.

This is, of course, an oversimplified statement of the argument. The author emphasizes the complexity of the interaction between genes and environment, and he is well aware that every individual is an integrated biochemical system. He recognizes that his approach offers no easy road to the solution of all biological and medical problems. He discusses the implications of his ideas for biological, medical, dental and psychiatric research. His observations on psychiatry will probably cause the lifting of eyebrows among some others than the Freudians whom he dismisses as a bad lot early in the chapter. Nowhere in the book is there any evidence of an awareness of the concepts of contemporary cultural anthropology or of any understanding of the genesis of the integration of human personality. The rôle which the author assigns to nutrition is somewhat extreme and his suggested applications sometimes raised echos of Gayelord Hauser in the mind's ear of this reviewer.

But to return from flippancy, the book is well worth perusal and serious consideration. It is particularly interesting because it contains parallels with developments in some other disciplines which are evidently the result of our present *Zeitgeist*. The au-

thor's concepts of individual variation and integration are very close to those of contemporary population genetics and systematics.

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THE BIOLOGICAL BASIS OF HUMAN FREEDOM: Theodosius Dobzhansky, Columbia University Press, New York 1956, 139 pp.

The author has attempted to show how man, who, as have all organisms, arose in the course of biological evolution, has continued in his evolution to a stage unique to human beings. Man's brain development made possible another great step in evolution, that is, cultural evolution. As a consequence of this step, man has been able to control many of the agents which otherwise might have caused the human species to continue diversification into various genetic types adaptive to different environments.

The book represents an expanded version of the Page-Barbour lectures the author delivered at the University of Virginia in 1954. Supporting references and illustrative examples have been held to a minimum to keep the text free of technical terms. A bibliography has been included to which a reader can refer if he wants more information.

Man is a child of biological heredity. He inherits genes from his parents. The gene complex, or genotype, is responsive to environmental agents. All of man's traits and qualities result from an interaction between his heredity and environment. Evolution of the human brain gave man the ability to develop a capacity for symbolic thought and to represent his thought by spoken and written words. This characteristic made it possible for man to receive information from his ancestors and to pass on the culture he "inherited" and that he learned from his own life experiences to his descendants and to others. Heredity is basic for man's culture. "Acquisition and maintenance of culture by learning is possible only owing to the biological organism with which the human species is genetically endowed." But culture as such is not biologically inherited. Man's ability to speak some languages is a matter of genes, but which language one speaks is a matter of culture.

Natural selection was proposed by Darwin as an explanation for nature's choice of the fittest. Some supporters of Darwin's theory have supposed that the theory of natural selection assumes that the "lusty" conquer in a struggle for existence that every living organism faces. The author opposes that idea. He does not consider natural selection to be a gladiatorial competition; nor does he look upon it as something altruistic. "Natural selection is opportunistic. It perpetuates those genetic constitutions which happen to exhibit a fitness superior to others at a given time, in a given place, and in a given environment." Modern interpretation emphasizes reproductive success as a factor in selection. If men with undesirable traits, as we consider them, have more progeny on the average than do men with desirable traits, reproductive success, or natural selection, will favor the preservation of the undesirable traits.

Some persons wonder whether or not natural selection still operates in the human species. The author differs with those who believe that natural selection is inactive in modern man because, as they say, man protects himself from the environment, medicine is used to help the weak survive and reproduce, and leaders have only small numbers of progeny. Selection is still a factor. Evidence for this is indicated by the differences in average number of children produced by members of a cultural group.

A reader may argue, and justifiably so, that cultural evolution has placed the reproductively successful families at a disadvantage. A man competes with his fellow

men in the culture which has evolved. Members of the human species fence for position. Learning is essential. The man who has the ability but lacked the opportunity to learn will not be very successful in this competition. If less successful persons have larger families than do the successful ones, the children in the large families usually have less opportunity to learn the cultural bases and, thus, will be unable to prepare for competing with members of their generation. Reproductive success, therefore, tends to work against this group. We can only hope that our cultural evolution will continue until it includes more of the Golden Rule. Then maybe the genetically gifted children in families having poor cultural background will be given an opportunity to develop to the best of their capabilities.

Cultural evolution has placed man beyond biological evolution. This part of the author's text appeals to readers who are disturbed by events occurring in the modern world whereby human dignity is ignored and man is treated as any other animal. Man differs from other social animals in that his behavior in a social group is in the main unfixed genetically. The base is set by genes, but the direction and extent of its development are, for the most part, culturally determined. Man has freedom of choice because his behavior is learned. This freedom to make an ethical choice is essential to the cultural evolution of man.

Animals other than man have the capacity to be trained and their differences are to a considerable degree genetic, as the author states. Biological as well as social scientists do not agree on whether or not races of men have different genotypes which result in differences in innate mental abilities. The fact that races live under different cultures clouds the problem. The reader is reminded that available paleontological evidence indicates that only one human species has existed at a given time. Physical differences between human races arose chiefly through natural selection as men migrated into various environments. The adaptive values of these physical traits are unknown. The importance of heredity as a cause of racial differences for psychic traits is not known, as the author states, and sufficient scientifically reliable data are not available for the problem to be solved. A reader may want to introduce his own opinions at this point. If psychic traits have a genetic base, races would be expected to differ for them because of differences in mutations, just as they differ for physical traits. The lack of reliable scientific data is no more striking and should be no more alarming than the lack of knowledge about the adaptive values of physical differences.

It is true as the author states that no correlation has ever been established between the contents of a culture and any physical or psychological characteristics of its possessor. Actually, though, we must recognize that this is one of the problems geneticists have neglected. The author takes to task extremists on both sides of the argument concerning the possible genetical explanation of cultural and psychic differences between races. All races have the ability to acquire and maintain culture. "This fundamental educability is not a distinguishing mark of any one race; it is a common property of the human species." The extent to which genetic differences between peoples have contributed to the emergence of differences between their cultures is an unsolved problem. As the author indicates, it has not been solved and can not be solved by dogmatic pronouncements. "Careful and unprejudiced studies have been few."

The author has an interesting discussion about the formation of codes of ethics. Natural selection has not propagated genes for ethics as such; for example, no genes evolved for inventing Euclid geometry. Ability to study geometry had no selective value in the ancestors of our species. However, ability of abstract thinking, of per-

ceiving casual relationships between events, did confer tremendous adaptive advantages. It let man achieve mastery over his environments. Natural selection may not have developed genes for philosophy but it has favored genetic endowments which enabled their carriers to become philosophers. To some extent readers will consider these statements similar to the often quoted statement that one does not inherit traits but genes that give him potentialities to develop a trait.

The author is to be congratulated for the manner in which he has handled the subject matter in this work. Controversial opinions have been presented. He has emphasized the need for scientific studies of the problems yet to be explained and has used a sharp sword against extremists and dogmatic pronouncements.

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COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY, Volume XX, Population Genetics: The Nature and Causes of Genetic Variability in Populations. The Biological Laboratory, Cold Spring Harbor, L. I., New York, 1955, 346 pp.

The Cold Spring Harbor Symposia volumes, of which Volume XX is the subject of the present review, have consistently achieved a level of excellence unsurpassed in scientific publications. This volume on Population Genetics is no exception. From the beginning of the review of fundamental concepts and problems of population genetics by Theodosius Dobzhansky through the concluding survey by I. Michael Lerner, the field of population genetics is authoritatively presented in seven equally fine sections: General Population Genetics Theory, Theory of Quantitative Genetics, Selection in Plants, Selection in Animals, Genetic Variability and Polymorphism, Populations in Time and Space, and, Integration of Genotypes. Theory, method, and original investigation are commendably integrated in each section, and the implications are carried across what might at first glance appear to be unsurpassable boundaries of specialization. The fundamental theme of the symposia, as of population genetics, " . . . the nature and maintenance of genetic variability in populations . . ." (Lerner p. 340) is developed from cotton, corn, and blackberries, to drosophila, butterflies, poultry, mice, and man. Accomplishment of this is, of course, immeasurably aided by the organization of the symposium, and by the format of the publication, which is now a well-established tradition of the Cold Spring Harbor Symposia. To the person interested in gleaning general concepts from the variety of individual papers, or making application to any one area of specific interest, this format is particularly valuable. Each session or section is concluded by a synthesis which brings together the essential elements of the preceding papers. The presentation of discussion and comments serve a similar purpose.

It is obviously not possible in a short review to do full justice to a volume such as this, which has so many important implications for human genetics, eugenics, and demography. Consequently, it will be necessary to be both selective and general in this review. Four of the main methods of studying population genetics are considered: "(1) a study of the changes in a character under different schemes of selection; (2) how genes interact to alter each other's effect and selective value; this includes what is often called developmental genetics; (3) investigations, by the construction of mathematical models, of how gene frequencies change under different circumstances; and (4) the observation of evolutionary changes which have occurred or are occurring in the wild" (Sheppard p. 273). As a result of the application of these methods, a consistent picture is revealed. From plant to man, populations are characterized by a wealth of latent genetic variability, (by whatever genetic

mechanism this variability is retained), capable of diverse adaptive responses to selection, while dependent upon a multiplicity of extra-genic factors, is invariably found to be related to gene interactions.

The population genetics depicted here may be complex, but certainly its future is clear. Where previously population genetics dealt with absolute values, and genes were considered to be either contributing to fitness or to be deleterious, it must now be recognized that a gene's contribution to fitness is both relative and subject to change. The selective value of a gene depends on the nature of the genotype, while the properties of the genotype in turn depend, to a considerable extent, on the past evolutionary history of the population to which it belongs (Mayr, p. 333).

The field of population genetics has passed the point for oversimplifications, and emphasis can no longer be placed upon single factors, genetic or environmental. One can not ask "are heterozygotes superior to homozygotes? Rather one must ask under what conditions are they superior, and to what extent? . . . The same gene may be of high selective value in large, or panmictic populations, but of low selective value in small, or inbreeding populations. Or else it may add to fitness in some small populations and not in others" (Mayr, p. 333). Attention must be given not only to the gene but also to complex units of genetic organization, gene blocks, chromosome segments, and even to the whole genotype. "The atomistic level of thought has to be replaced by the molecular or molar one," which again attaches significance to gene interactions (Lerner, p. 335).

The few summarizing statements which have been included here should indicate to the eugenist the importance of the recent advances in population genetics. Certainly there is no question but that acquaintance with the experimental demonstrations of the genetic properties of populations presented in the various sections of this volume would be of inestimable value to all concerned with human problems.

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HERITABLE DISORDERS OF CONNECTIVE TISSUE. Victor A. McKusick, Mosby Co., St. Louis, 1956, 224 pp. $7.50.

In the preface of this scholarly book the author states two objectives: to synthesize the scattered information about several heritable disorders of connective tissue, and to see what justification could be found for the notion that hereditary pathological syndromes are tools for study of the normal situation. If the latter objective is not as well achieved as the former, the fault lies not with the author but with the lack of information about the basic defects in the diseases concerned. The material is mainly clinical, with little emphasis on formal genetics and virtually none on specifically eugenic questions. The book will have its greatest value to geneticists as a text wherein the principles of developmental genetics are applied to clinical examples.

It is well-known to developmental geneticists that a specific gene may vary widely in its expression, depending on the rest of the genotype and the environment in which it works. Physicians accept the same principle in the case of pathogenic organisms; the tubercle bacillus, for instance, may produce widely differing results in individuals of different genetic constitutions, or living in different environments. Yet when it comes to rare genes causing disease in humans this principle appears not to be so well appreciated. One hears statements such as "this is not a case of the Laurence-Moon-Biedl syndrome because there is no retinitis pigmentosa" (yet). This may be true if one insists on reserving the eponym for cases showing all the features described by the original

authors. But if one thinks in terms of causes, rather than historical accidents, a child showing all the features described in the classical syndrome except retinitis pigmentosa is just as eligible to be labeled Laurence-Moon-Biedl syndrome as his brother who has all the classical features, since they both suffer from the effects of the same gene pair.

Dr. McKusick illustrates this point beautifully in his essay on the Marfan syndrome. In this disease the presence of a dominant gene is associated, in varying degrees, with long thin extremities, lax ligaments and joint capsules, ectopia lentis or high myopia, and diffuse dilatation or dissection of the aorta. It is suggested that the basic defect may be in the elastic fibers, which undergo degeneration in varying degrees in many parts of the body due to a constitutional weakness (abiotrophy). A "pedigree of causes" is presented in which one can theoretically trace from the basic defect the multitudinous widespread and variable results in the various organs involved. Whether or not the details of the "pedigree" are accurate, it is clear that although persons known, on genetic grounds, to be carrying the gene usually have one or more features of the disease, they do not necessarily have them all, by any means. When the gene occurs with a pyknic constitution, for instance, even the arachnodactyly (long fingers) may be suppressed and the patient may actually become obese. (For this reason, incidentally, Dr. McKusick favours the use of eponyms for such syndromes; they may be harder to remember, but they do not emphasize one aspect of the disorder at the expense of other, equally important ones.) One cannot, therefore, rule out the diagnosis of Marfan's syndrome in a patient with, say, a dissecting aortic aneurysm, merely because he does not have "spider fingers."

Thus the family history may be most important in such a case, since the finding of other, more typical, cases in the family may be the only way to establish the diagnosis. Awareness of these conditions will encourage the physician to search in the patient *and his family* for such things as ectopia lentis in cases of aortic aneurysm, telangiectases or pseudoxanthomata in cases of gastric hemorrhage, and the Kaiser-Fleischer rings (pigmented rings in the iris) of hepatolenticular degeneration in cases of unexplained liver disease.

The book begins with a short chapter on the clinical behavior of hereditary syndromes and a concise review of the biology of normal connective tissue. The author then presents the essay on Marfan's syndrome referred to above. From the numerous case histories and illustrations, mostly from Dr. McKusick's own practice, the physician can get a most helpful picture of the wide range of variation in this protean disease. There seems to be an occasional tendency to accept uncritically certain claims; one would like to know, for instance, whether cleft palate really does occur more frequently in cases of Marfan's syndrome than in the general population, and whether the author's reference to a Marfan-like syndrome due to maternal infection with rubella, or to rh incompatibility, describes anything more than a coincidence. From the point of view of the eugenist and genetic counselor it would be useful to know the probability of a particular offspring of a person with Marfan's syndrome developing, say, a dissecting aneurysm, or ectopia lentis, but perhaps the data from which such empirical estimates might be made are not available. Discussion of the genetics of the disease is brief, and no attempt is made to analyze critically the familial distribution of this or other diseases discussed later in the book. The author agrees with previous investigators that Marfan's syndrome appears to show autosomal dominant inheritance, with estimates of penetrance and mutation rate varying with the degree of effort spent in examining families, and the criteria of what constitutes an acceptable case of the disease. Dr. McKusick's own impression,

presented without supporting data, was that no more than 15 per cent of all cases are new ones.

The following chapter deals with the Ehlers-Danlos syndrome, in which a hyperextensible and fragile skin is combined with hyperextensible joints, and to a varying degree with other abnormalities such as muscular hypotonicity, and recurrent dislocations of certain joints. It is not clear to the reviewer whether other, more uncommon features such as spina bifida and arachnodactyly reported to be associated with the Ehlers-Danlos syndrome are related to it causally or coincidentally. The basic defect is not yet well-defined, though the author appears to favour the theory that it is a disorder of the organization of collagen fibrils into bundles. The pattern of inheritance also is not clear. It appears to show regular dominance in some families, and in others the apparently irregular pattern may be due to failure to recognize the condition in mildy affected individuals not specifically examined for it.

The next chapter deals in a similar way with osteogenesis imperfecta (brittle bones, blue sclerae and deafness). Here another result of the failure to recognize the variability of gene effects is pointed out. Many clinicians have separated the diseases into at least two separate categories, the severe and often fatal "congenita" form, and the milder "tarda" type with post-natal onset. Family studies show that the two types are the result of the same genetic defect, the distinction being only one of degree. The basic defect, associated with a dominant gene, may be in the maturation of collagen beyond the reticulin fiber stage, leading to widespread and variable abnormalities of bone, skin, ligaments, tendons, fascia, sclera and inner ear.

Pseudoxanthoma elasticum is the subject of the following chapter. The genetics of this disease has not been clearly worked out, but from the rather scanty literature the author concludes that there are probably two, clinically indistinguishable, genetic types, one autosomal recessive with partial limitation to the female, and one autosomal dominant. The syndrome includes a peculiar thickening and yellowish coloration of certain areas of the skin, angioid streaks of the fundus oculi, and signs of arterial degenerations — hemorrhage, ischemia or hypertension. The basic defect is thought to be an abiotrophic degeneration of collagen.

Finally, there is an essay on Hurler's syndrome (gargoylism, dysostosis multiplex), a form of dwarfism with skeletal deformities, deafness, hepatosplenomegaly, heart disease, mental retardation, and a peculiar, characteristic facies. The basic defect is not yet specified, though it appears to involve some disorder of polysaccharide metabolism. The inheritance is often autosomal recessive, but there is a sex-linked form with some clinical differences such as absence of corneal opacities. The helpful analysis by Herndon (Proc. Assoc. Res. Nerv. Ment. Disease *33*:239, 1954) of the clinical differences between the two genetic types is not mentioned.

The last chapter reviews briefly a number of conditions that may be heritable disorders of connective tissue, but in which the evidence is inadequate for a definite decision. These include fibrodysplasia ossificans progressiva, osteopoikilosis, Leri's pleonosteosis, and Paget's disease of bone.

The book is remarkably free of typographical errors, and the reproductions are good. The style is smooth, but there has been no attempt to simplify the medical terminology. The book will be most useful to physicians who wish to gain a comprehensive well-balanced picture of the conditions dealt with. For the geneticist it will provide illustrative material on the medical applications of genetics, and inspire further investigations in this fertile field.

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THE CHEMICAL BASIS OF HEREDITY: Edited by William D. McElroy and Bentley Glass. The Johns Hopkins Press, Baltimore, 1957, 848 pp.

This is an extremely valuable book for those who are initiated and wish to delve deeper and deeper into the problems of biochemical genetics.

Inasmuch as it is a report of a symposium in which more than three dozen major contributors took part, it is obvious that many points of view are represented. Perhaps not so obvious is the fact that the whole (due to the intricacies of the field) does not represent a very well-organized coordinated unit.

"Part I" is entitled "Cellular Units of Heredity," but the reviewer finds it difficult to differentiate between the kind of material presented here, as compared, for example, with that in Part II entitled "Role of the Nucleus, Nucleic Acids and Associated Structures in Cell Division and Protein Synthesis." It would almost seem desirable to admit that the book consists of "miscellaneous contributions." These individual contributions do not lose their extreme value because of not being well knit together. This book contains some of the most valuable material which has come out in this field in recent years. It is not for the elementary student.

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THE POPULATION OF JAMAICA: George W. Roberts, Cambridge University Press, Cambridge, 1957.

George Roberts' book is the latest of a small but growing group of volumes devoted to the demographic analysis of underdeveloped countries. Because Jamaica culturally and historically has much in common with other West Indian islands and because relevant comparative data are often provided, this study adds a great deal to our knowledge of British West Indian population structure and dynamics.

The book is organized along the lines of classical demography, its major chapters devoted to Population Growth, Population Characteristics, External and Internal Migration, Mortality, Fertility, and Population Projections. In handling these subjects, Roberts proves to be not only a facile demographer but a competent historian. A heavy reliance on primary sources, careful evaluation of these sources, and an absence of excessive generalization give the reader confidence in conclusions reached from admittedly fragmentary historical materials. While the historical analysis is usually pertinent and helpful (especially the information on reproductive patterns in the period of slavery), Roberts' historical zeal occasionally seems excessive. Thus, after twenty pages (6 per cent of the text) of historical materials on indenture immigration from India, we discover that over the seventy-year migratory period "a negligible annual average increment to the population of the island of about 500" was effected, and that the total net immigration was well under 25,000.

Some of the main features of the Jamaican population picture display a pattern familiar to students of demographic change. The turning point for major shifts in demographic variables appears to have occurred around 1921. Mortality, long constant, began to decline, and from that date to 1950 life expectancy at birth has increased by twenty years. Fertility, as measured by crude rates and Joint Gross Reproduction Rates, declined by about 20 per cent in the twenty-five years following 1921, but now show signs of stability. Due to the failure of fertility declines to keep pace with those of mortality, Jamaica is now characterized by a low crude death rate (12) and a moderately high birth rate (34). This has effected a rate of growth nearly twice that of a century ago.

Migration, earlier characterized by a

fairly heavy net out-migration (146,000 from 1881-1921) and a relatively modest internal migration, changed to a small net in-migration from 1921 to 1943 and an impressive acceleration of internal migration, especially to the metropolitan area of Kingston-St. Andrew. Thus, in 1943, 21 per cent of the population were not residing in the parish of their birth.

A number of Roberts' findings will be of interest to urban sociologists. For example the increase in female participation in the labor force which ordinarily accompanies modernization has thus far operated in reverse in Jamaica. Whereas 75 per cent of the females over ten were employed in 1891, by 1943 this proportion had fallen to 34 per cent. This reduction largely reflects a female withdrawal from agricultural employment, a trend which Roberts believes due to "a continuation of the break with the slave society in which every adult was potentially a 'work unit.'" If true, this should have interesting implications for female attitudes toward employment, especially when combined with attitudes toward the status of marriage — another break with slavery patterns.

The volume, direction and composition of internal migration, on the other hand, show striking similarities to American and European experiences, despite the absence of any significant industrialization. Thus, while earlier (pre-1921) internal migration tended toward the city proper, subsequent movement has tended to be more suburban. There is also evidence of migration in stages. For example, those parishes which lost population as a result of inter-rural migration lost most to their contiguous parishes nearest to Kingston. Finally, the metropolitan sex ratio is significantly lower than those found in rural parishes, suggesting the disproportionate urbanward migration of women.

Roberts' most significant contributions occur in the area of fertility. He demonstrates that traditional demographic techniques which assume that marriage signalizes the commencement of reproductive behavior are inapplicable in areas such as Jamaica where the illegitimacy rate is about 70 per cent. From an analysis of three types of marital categories—married, "common-law" (which has no legal status) and single (which includes the truly single and those in "keeper" or non-domiciliary unions) — it is disclosed that spacing between births is longest and consequently fertility is lowest among the single, highest among the married. Average completed fertility is lowest among the single, highest among the married. Average completed fertility per mother is 6.6 children for married, 4.7 for single and 5.6 for common-law.

Based on the incidence of the various types in different age groups, Roberts believes that there may be a pattern of movement from single to common-law to marriage status. There seems little question that this unstable mating system considerably reduces fertility. Moralists who blame population pressure on non-legal marriage forms will be further surprised at Roberts' ecological correlations showing a strong *inverse* relation between fertility and illegitimacy. The entire analysis throws doubt on comfortable assumptions about further social and economic development bringing "inevitable" declines in fertility. Indeed, such changes would probably increase the incidence of marriage, which would, in turn increase fertility, other things being equal.

Other factors such as the spread of fertility control must of course be considered. Some data suggest that such practices have already made inroads. Not only are there significant rural-urban fertility differentials (*e.g.*, in 1943 Joint Gross Reproduction Rates ranged from 1.62 in the metropolitan area to 2.84 in one of the rural parishes), but (a) the parishes closest to the metropolitan area have shown the greatest declines in fertility, and (b) the inverse relation between fertility and literacy is a

relatively recent phenomenon.

West Indian social and economic planners will find Roberts' chapter of population projections the most significant, and, possibly, the most disturbing. On the assumption of constant fertility, declining mortality and no migration, the population will increase by about 58 per cent in the two decades after 1951—the increase of 822,000 falling little short of the increase of 860,000 which occurred over the entire century preceding 1943.

Even on the somewhat optimistic assumptions of a 17 per cent decline in fertility over the twenty-year period, an annual emigration rate of one per cent from 1956, and declining mortality, the population will increase by 35 per cent or 496,000 between 1951 and 1971. It is clear that economic and social progress for Jamaica, as for other areas in the transitional growth phase, will not be achieved easily in the face of such rapid population increments.

Although an incidental effort at pertinent summarization is made in the final chapter on growth prospects, it seems regrettable that a more systematic attempt was not made to summarize and highlight those findings of relevance for the shapers of national policies and programs. This would seem especially important in the light of the crucial significance of this study for the new Federation of the West Indies. In a broader sense, the reviewer feels that because the skilled analysis of economic and demographic data is at a premium in such areas, each major publication of this type should take special pains both to elaborate and pin-point those aspects of the analysis which could be of relevance to statesmen and the broader audience of public planners.

This limitation is of course irrelevant to consideration of the volume as a piece of demographic research. In this regard it is a highly competent study which could well serve as a model for future demographic investigations in the understudied, underdeveloped regions of the world.

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PERIODICAL REVIEWS

GENETICS

Genetic and non-genetic factors in the etiology of congenital heart disease: a study of 1188 cases. M. Lamy, J. de-Grouchy and O. Schweisguth. *American Journal of Human Genetics* **9** (1957), pp. 17-41.

The causes of heart anomalies are complex, and differ from one anomaly to another. The authors studied 1188 children clinically and questioned the families of these and of 600 normal children. Some defects occurred predominantly in males or in females, but the overall sex ratio was normal. Although the incidence of consanguinity in the parents was only 2.4 per cent, this figure is nearly four times as high as that for the controls; it was most frequently associated with pulmonic stenosis, a narrowing of the valve admitting blood to the lung circulation. Patients with this defect also had the highest incidence of siblings with heart defects, reinforcing the impression that pulmonic stenosis may have a larger genetic component than the other major defects.

Abnormal pregnancies were relatively frequent in histories of all the cardiac patients except those with pulmonic stenosis. Abnormal pregnancies were especially frequent in cases of "ductus arteriosus," in which a persistent fetal blood vessel bypasses the lungs. The frequency of twins was not increased among the patients, but that of triplets was. Seven identical twin pairs were all discordant, while in one of nine fraternal pairs both members had heart defects.

This is a valuable piece of research, but the analysis of the potentially very informative twins and triplets is disappointingly superficial. There is a great need for better methods of utilizing twin data and for wider familiarity with the methods already available.

Genes, the heart and destiny. P. D. White. *New England Journal of Medicine* **256** (1957), pp. 965-969.

Medicine has long paid only lip-service to the acknowledged principle that diseases must be explained in terms of individual susceptibility as well as of external causes. With respect to heart diseases, heredity is doubtless important not only in rheumatic fever but also in congenital heart disease, hypertension and coronary artery disease. In instances where disease is not clearly attributable to hereditary defect, it is still worth-while to look for individual differences that may mark the susceptible person. Prevention will then be much easier.

Symposium on inborn errors of metabolism. C. E. Dent, V. A. McKusick, *et al. American Journal of Medicine* **22** (1957), pp. 671-783.

This is a stimulating collection of papers reviewing and, one might say, previewing, the growth of the concept of inborn errors of metabolism in medicine. In the foreword, Dent makes a number of good suggestions, and emphasizes the great aid to medical diagnosis afforded by discovery of discrete chemical defects associated with disease. He urges an active search for underlying hereditary defects in every homogeneous disease of undertermined etiology. McKusick places primary emphasis on the study of biochemical disease mechanisms, both because it is the most promising approach to therapy and because it elucidates normal metabolic phenomena.

The succeeding papers discuss hereditary

diseases in which recent important advances have been made: phenylketonuria, galactosemia, familial cretinism, congenital hemolytic anemias, hypophosphatasia, Wilson's disease, porphyrias and cystinuria.

The article by White and the above symposium appeared in the same month in two leading medical journals. They seem to indicate an important trend in American medicine toward recognition of the potential contribution of genetics to medical science.

Genetic research on cancer of the uterus, Part II. P. E. Beolchini *et al. Acta Geneticae Medicae et Gemellologiae* **6** (1957), pp. 59-84.

Of 144 consecutive patients with cancer of the corpus of the uterus, 91 were used in a family study. The incidence of cancer in their relatives was compared with that in relatives of 91 matched controls. Relatives of the cancer patients had three times as much uterine cancer (corpus or cervix not specified) as relatives of the controls, and a higher incidence of cancer in general. The excess of uterine cancer was statistically significant; that of other cancers was not.

These findings seem to reinforce the conclusions of several other investigators, but all control studies in humans are open to some criticisms. This report gives very few methodological details on which an evaluation can be based.

Red-green color blindness in a heterogametic apparent female, together with a contribution to the genetics of heterogametic pseudofemaleness. W. Lenz. *Acta Geneticae Medicae et Gemellologiae* **6** (1957), pp. 231-246.

Retarded growth and maturation are described in a 14-year-old girl. Examination of her white blood cells showed them to have typical male nuclear characters, indicating an XY (heterogametic) chromosomal constitution. She was also found to be red-green color blind like her brother and two maternal uncles. When this intersexual condition is associated with female breast development, it often appears to follow the pattern of sex-linked recessive inheritance. However, the same pattern would be simulated in this disease by dominant, *sex-limited* inheritance. Sex-linkage can be excluded in families like the present one, in which the same X-chromosome, carrying color blindness, is also found in normal males.

The significance of sex differences in somatic cells. H. F. Bettinger. *Medical Journal of Australia* **1** (1956), pp. 1001-1003.

There is always a strong desire on the part of family and physicians to discover the "true sex" of persons with intermediate sexual development. This has now been greatly facilitated by discovery that genetic or chromosomal sex can be determined merely by examining a blood film (or other cells) from the patient. But sex is governed by a delicate genic balance which may not always coincide with the number of X chromosomes. When the male and female genes are so evenly balanced that anatomical structures fail to differentiate properly, the psychological make-up remains the final, and in humans certainly the most significant indicator. In medical and social management of intersexuality, therefore, the "chromosomal" sex should be ignored.

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POPULATION

Some aspects of the development of demography. David V. Glass. *Journal of the Royal Society of Arts* **104,** 4987 (September, 1956), 854-868.

This survey of the development of demography from John Graunt to the present emphasizes particularly what has happened in Great Britain. The gradual improvement of data collection in respect to both fertility and mortality is described, with stress on the crudeness of some of the earlier materials and on certain of the insights that brought progress. Migration is not considered.

Noting that a belief in the existence of constant underlying behavior patterns that once dominated demographic investigation has relaxed in considerable measure, the author points to the model of the simple demographic transition as embodying some remnant of the earlier approach and thus liable to overlook the importance of deviant cases. Past emphasis on ordering sets of data by year of occurrence rather than by generation of persons to whom they refer is another example of the traditional demography that is now breaking down. Use of the generation approach in many areas of social research and a closer relationship between demographers and other social scientists are suggested as two important paths of future development.

Demographic techniques and Jewish education. C. Morris Horowitz. *Jewish Education* **26,** 2 (Fall, 1955), 17-23.

Taking as his point of departure the importance of demographic information about the Jewish community to an assessment of the Jewish educational system, the author describes and evaluates seven methods for obtaining Jewish population data. These are: the U.S. Census of Religious Bodies, not taken since 1936; the "Yom Kippur" method, based on the rate of public school absenteeism on the Jewish holy day; "interpolation from census data" on the assumption that in certain areas the Jewish population is similar to the general population or to the Russian-born population; the "master list" method, which attempts to assemble from various sources a complete list of Jewish persons; the "Jewish name" method, premised on the ability of the investigator to recognize the names of Jews; U.S. Census Bureau matching, leading to tabulation of census data for individuals named on lists furnished to the Bureau; and death rate and birth rate techniques that attempt to estimate the Jewish population from Jewish vital rates. All of these diverse procedures are found wanting because of inaccuracy, non-comparability, or failure to furnish the desired information.

In the author's view, the only satisfactory method of collecting Jewish population statistics, short of including a religion question in the U.S. Census of Population, is the sample survey, preferably conducted under the auspices of a Jewish university.

Demographic pressures in North Africa. Jean Chardonnet. *Migration News* **6,** 1 (January-February, 1957), 3-7.

It is the chief contention of this article that demographic pressure will become increasingly the key problem in French North Africa, regardless of political developments. This pressure results from a high birth rate (30 to 40 or more per thousand) and a falling death rate, which combine to yield an annual growth of 1.5 to 2 per cent.

Unemployment, underemployment, and a very low standard of living characterize the area. The outlook for the future is even worse, since the high birth rate may well be maintained, while reduction of mortality, especially infant mortality, is quite conceivable. The traditional solutions of agricultural expansion and emigra-

tion are viewed as indispensable but inadequate. "Overpopulated countries . . . have a means of avoiding underemployment . . . , by selling products manufactured in their own industries" (p. 7). Hence industrialization, though it will not come about easily, must be explored as "the only means of contributing efficaciously to relief of the appalling demographic pressures."

It seems to the reviewer an important omission for even so brief a study not to consider the possibility or desirability of some more direct attempt to meet the problem of the high birth rate.

Social change, religion, and birth rates. Albert J. Mayer and Sue Marx. *American Journal of Sociology* **62,** 4 (January, 1957), 383-390.

Evidence as to the speed with which a small family pattern can be adopted in an urban industrial setting by a population whose cultural background favors high fertility was sought through a study of the 1920, 1930, 1940, and 1950 birth certificates of Hamtramck, Michigan, an enclave of Detroit. As of 1930, 80 per cent of the population was of Polish birth or parentage, with most of the foreign-born 38 per cent probably of rural origin. Throughout the period studied, Hamtramck has been very heavily a working-class community and at least 90 per cent Roman Catholic.

The total fertility rates found for the white population compare with those of Detroit as follows:

Year	Hamtramck	Detroit
1920	5,768	3,019
1930	2,492	2,131
1940	1,760	1,830
1950	2,262	2,604

Examination of the data by natality, occupation of husband, and religion leads to the conclusions that "foreign-born mothers accepted fertility controls almost as readily as the native-born" (p. 386), that fertility of lower occupational groups dropped more slowly than that of higher groups at first but was falling faster by 1940, and that there was "little relationship between religion and fertility rates" (p. 388).

On the basis of information supplied by social workers, it appeared that deliberate birth control, mainly induced by the level of wages, was the immediate cause of the decline of fertility in Hamtramck. The authors hypothesize that the rapid change in attitudes and behavior was related to a general wish to be Americanized.

While the striking overall decline in fertility is clear in the data, the reviewer would be interested to know the importance of the special depression circumstances of 1930 in determining the change between 1920 and 1930.

Reproductive span and rate of reproduction among Hutterite women. Christopher Tietze. *Fertility and Sterility* **8,** 1 (January-February 1957), 89-97.

The Hutterites, a Protestant sect living in the Dakotas, Montana, and nearby Canada, are a contemporary American community in which no form of birth control is practised. Histories of 209 women of this group, all married by age 25 and all still living with their husbands at age 45, are examined in this study. Particular attention is given to 132 mothers for whom not merely year or month but exact date of each birth is known.

The mean age at last confinement was 40.9 years, the mean elapsed time between first and last confinements was 18.7 years, and the mean interval between confinements was 25.5 months. Assuming that 10 per cent of pregnancies end in fetal death, the mean interval between pregnancies was 13.3 months. The mean interval between marriage and first conception was 7 months. The observed pregnancy rate of 89 per 100 years of exposure is similar to that of comparable non-contracepting groups in the general population.

Considerable variations in length of reproductive span and in rate of reproduc-

tion were noted, but the two types of variation did not appear to be associated. There was a marked increase in the average duration of interval between confinements with increasing age of mother.

Although it is to be regretted that because of the fact that the data for this study were obtained as a by-product of the investigation of another subject, certain important matters such as coital frequency could not be considered, this report is a valuable addition to the available information on reproduction in the absence of contraception.

New maps of China's population. Glenn T. Trewartha. *Geographical Review* **47,** 2 (April 1957), 234-329.

The last population estimates of the Nationalist government of China, published in 1948, served as the basis for the maps presented in this article. More recent figures could not be used because they do not give the population by small political subdivisions (*hsien*) but only by provinces. Two maps are offered, a dot map slightly larger than 19 by 17 inches in size, using one dot per 5,000 persons; and an isoline map showing population density in the eastern portion of the country.

The most striking feature of the maps is the fact that less than half the area of China supports 96 per cent of the population. In an agricultural economy dependent on hand labor, the people are concentrated on the alluvial plains that permit high population density under a vegetarian diet. The density already achieved now renders diversification of agriculture and better use of less desirable sites exceedingly difficult. Only in Szechwan province do population concentrations fail to coincide with alluvial lowlands.

Speculations on population growth and economic development. Stephen Enke. *Quarterly Journal of Economics* **71,** 1 (February 1957), 19-35.

How countries with high birth and death rates are most likely to be successful in their attempts to achieve improved levels of living is a complicated question involving a variety of economic, demographic, sociological, and other factors. It is the author's contention in this article that short-run policies should be aimed at higher per capita total output rather than higher per capita consumption, in order to furnish the necessary additions to plant and equipment. Hence, "there may be substantial long-run advantage in investing in urban facilities and plants, rather than in increasing the food supply through, say, land reclamation projects" (p. 19).

Part of the purpose of concentrating on urban development would be to bring more of the population under the influence of the urban milieu that is presumed to lower fertility. Further contributions toward restraint of population growth might come from taxation and housing policies that favored late marriage and small families. Although the author admits that such devices may seem farfetched, he asserts that "any country with limited food supplies is approaching an emergency if its population is increasing at 1.5 per cent each year" (p. 23).

To illustrate the points made, tables are furnished working out the implications over a half century of two alternative models of economic development. With the assumptions chosen, the scheme focusing on early urban development shows a small net increase in per capita consumption, while that embodying intensive land reclamation ends with a decrease in per capita consumption: the main cause of the final difference being the unequal rates of population growth of the two models.

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